

# CAPITALISM'S DIRTY SECRET

A RESEARCH REPORT INTO THE  
USES & ABUSES OF SPREADSHEETS

# FOREWORD

This timely report highlights a very real problem; spreadsheets play a crucial and central role in modern business across the globe, and yet it seems there is often strikingly inadequate training available for those that use them. Also, the potential for systemic risk from poor spreadsheets is significant.

As the business world looks to anticipate the next potential crisis, this may well be an area to consider. This is why ICAEW crafted our 20 Principles for Good Spreadsheet Practice; to try and help business understand the risks and how to mitigate them. This report shows that businesses should take this issue seriously and urgently consider the best strategies to ensure they are protected in the future.

## **RICHARD ANNING**

Head of IT Faculty,  
ICAEW (Institute of Chartered Accountants in England and Wales)

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**“BEWARE OF GEEKS  
BEARING FORMULAS”**

Warren Buffett

## ABOUT F1F9

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F1F9 provides financial modelling and excel analytical support to clients ranging from start-up entrepreneurs to blue chip corporates. We also teach financial modelling skills to companies around the world. Our clients have access to high quality, cost effective modelling support delivered by over 50 professional modellers.

F1F9 co-developed the FAST Standard that allows modellers and non-modellers to work together and understand financial models. Transparency is the core value that drives our modelling and our business activities.

## ABOUT THE AUTHOR

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Kenny Whitelaw-Jones is Managing Director of F1F9. He worked with some horrific financial models early in his career and vowed to save others from the same fate by teaching them modelling techniques that actually work. That's why he's passionate about raising standards in modelling. He is one of the founders of the FAST Standard Organisation.

# SPREADSHEETS PLAY A **CRITICAL ROLE** IN BUSINESS DECISION MAKING GLOBALLY.

*Warren Buffet famously said "Beware of geeks bearing formulas".*

*Grenville Croll, a leading spreadsheet risk commentator, said, "Spreadsheets have been shown to be fallible, yet they underpin the operation of the financial system. If the uncontrolled use of spreadsheets continues to occur in highly leveraged markets and companies, it is only a matter of time before another 'Black Swan' event occurs causing catastrophic loss."*

At F1F9 we've long viewed spreadsheets as Capitalism's Dirty Secret. Many people know that there are deep-seated systemic problems, but nobody is talking about them.

We commissioned YouGov to undertake research to obtain empirical data about how spreadsheets are being used in business. Details of the research methodology are set out in Appendix B. Although the research was conducted with the help of over 1,200 UK-based senior managers and above, we suggest the results apply globally.

The data supports what we see in the market every day:  
[Spreadsheets play a critical role in business decision making globally.](#)

Many businesses don't understand the risks they are exposed to, under-invest in spreadsheet training and don't adhere to best practice. Lack of training is leading to direct financial loss, poor decision making and employee stress.

# 1. INTRODUCTION

# 2.

## HOW SPREADSHEETS ARE USED IN BUSINESS

Spreadsheet analysis plays a critical role in global business. 71% of large British businesses **always, or often, use spreadsheets** for key financial decisions. (SOURCE: YOUNG & RUBICAM)

Using government data, and the results of the YouGov spreadsheet study, we estimate that:

### 1

#### ACCOUNT PREPARATION

SPREADSHEETS ARE USED IN THE PREPARATION OF BRITISH COMPANY ACCOUNTS WORTH **UP TO £1.9 TRILLION.**

Total private sector turnover in Great Britain is £3.46 trillion. (SOURCE: DEPARTMENT FOR INNOVATION AND SKILLS).

56% of British companies use spreadsheets to prepare their accounts. (SOURCE: YOUNG & RUBICAM)

### 2

#### PRICING DECISIONS

THE UK MANUFACTURING SECTOR USES SPREADSHEETS TO **MAKE PRICING DECISIONS FOR UP TO £170 BILLION** WORTH OF BUSINESS.

British manufacturing output is £354.5 billion. (SOURCE: ONS)

48% of manufacturing businesses use spreadsheets to manage pricing decisions. (SOURCE: YOUNG & RUBICAM)

These financial impact estimates are ours, based on public data.

The research data confirms, however, that spreadsheets are critical throughout business.

### 3

#### INVESTMENT DECISIONS

SPREADSHEET ANALYSIS UNDERPINS UP TO **£38 BILLION OF BRITISH PRIVATE SECTOR INVESTMENT DECISIONS** PER ANNUM.

British businesses invest £176 billion per year. (SOURCE: ONS)

22% of those investment decisions are underpinned by spreadsheet analysis. (SOURCE: YOUNG & RUBICAM)

### 4

#### BUDGETING & FORECASTING

**72% OF MEDIUM AND LARGE BUSINESSES** USE SPREADSHEETS FOR BUDGETING AND / OR FORECASTING.

(SOURCE: YOUNG & RUBICAM)

At F1F9 the fastest growing part of our business is supporting clients to manage the spreadsheets used for budgeting and forecasting. We often find that these spreadsheets are **poorly understood and version control is poorly managed**. While many large clients have sophisticated ERP systems in place, these often lag behind the needs of the business and much of the "real work" happens in spreadsheets.

**78% OF BRITISH BUSINESSES SAY THAT KEY FINANCIAL DECISIONS ARE SUPPORTED BY SPREADSHEETS.** (SOURCE: YOUNG & RUBICAM)

Given the critical role of spreadsheets, it would be reasonable to expect businesses (in the UK and globally) to ensure that spreadsheets are well managed and conform to a standard, and that analysts are well trained.

# 3. THE LACK OF SPREADSHEET TRAINING

Given the critical role that spreadsheets play in business decision making, companies should be ensuring that analysts and decision makers are properly trained. The YouGov research data suggests a lack of investment in this.

59% SAID THEIR COMPANIES HAVE **SPENT NOTHING** ON EXTERNAL SPREADSHEET RELATED TRAINING IN THE PAST 12 MONTHS.

Even in Finance and Accounting, where we would expect spreadsheet analysis to be more of a "core skill", 40% of companies said they spent nothing on spreadsheet training.

IN ONE THIRD OF BUSINESSES (30%), **NONE OF THE FINANCIAL DECISION MAKERS** HAVE EVER RECEIVED ANY OFFICIAL EXTERNAL SPREADSHEET TRAINING.

Very often senior decision makers rely on their more junior analyst colleagues to *run and understand the spreadsheet*.

Some of the most critical business decisions are made upon analysis delegated down to the most junior of staff.

Problems often arise as these junior analysts may not possess the necessary commercial comprehension to model the situation correctly. In addition, when those juniors move on or are unavailable there may be nobody around who understands the spreadsheet.

ONLY 6% SAID THEIR BUSINESSES HAVE SPENT **MORE THAN £5,000** ON EXTERNAL SPREADSHEET TRAINING IN THE LAST 12 MONTHS.

This figure applies across the whole business and is not a per person figure. This should be compared with the fact that in 2013, British companies spent an average of £2,550 per person on training as a whole. (SOURCE: 2013 COMMISSION FOR EMPLOYMENT AND SKILLS)

In our experience, companies do not place enough emphasis on professionalising spreadsheet modelling. Because Microsoft Excel appears on every computer as part of the Office suite, and is easy to use for most people, we see a generally accepted view that spreadsheet training is unnecessary. This view seems to be borne out by the data.

The YouGov data tells another story however, that calls into question the validity of this view:

**LACK OF INVESTMENT IN TRAINING IS RESULTING IN LOST MONEY, LOST TIME AND POOR DECISION MAKING.**

# 4. THE CONSEQUENCES OF POOR SPREADSHEETS

It is clear from the YouGov data that the senior decision makers are aware that poor spreadsheets are negatively impacting their business.

17% OF LARGE BUSINESSES HAVE SUFFERED **FINANCIAL LOSS** DUE TO POOR SPREADSHEETS. (SOURCE: YOUNGOV)

This population represents companies with a combined turnover of £318bn, around 9% of UK total private sector turnover. (SOURCE: ONS)

Although it is not possible to quantify the scale of losses, 16% of large businesses have experienced **inaccurate information in spreadsheets more than 10 times in the last year.** (SOURCE: YOUNGOV)

1 in 25 large businesses (4%) have experienced inaccurate information in spreadsheets more than **30 times in the last 12 months.** (SOURCE: YOUNGOV)

57% OF LARGE BUSINESSES SAY BAD SPREADSHEETS HAVE CAUSED **WASTED TIME.** (SOURCE: YOUNGOV)

Again, although the amount of time wasted has not been quantified in this research, 57% of large UK businesses represent 5.7 million employees. (SOURCE: UK DEPT FOR INNOVATION AND SKILLS)

33% OF LARGE BUSINESSES REPORT **POOR DECISION MAKING** DUE TO SPREADSHEET PROBLEMS.

There appears to be a **link between company size and prevalence of poor decision making** being caused by spreadsheets. 9% of small businesses have experienced this, and 20% of medium size businesses.

Our view is that as businesses increase in size and complexity, and also in sophistication, **decision making becomes more complex** and requires more spreadsheet analysis and modelling.

This data shows that the senior decision makers are aware that spreadsheet models are having a negative impact on their business.

**WHAT'S LESS CLEAR IS WHY THIS ISN'T TRANSLATING INTO ACTION TO IMPROVE SPREADSHEET MODELLING.**

# 4. CASE STUDY: SPREADSHEET USE IN ENRON

Felienne Hermans, of Delft University of Technology, recently published a [research paper](#) containing her analysis of 15,770 spreadsheets used in Enron.

These spreadsheets were obtained from the [Enron Email Corpus](#), which is a database of over 600,000 emails generated by 158 employees of the Enron Corporation. These emails were acquired by the Federal Energy Regulatory Commission during its investigation after the company's collapse, and are publicly available. These emails were not voluntarily handed over but gathered for evidence. They therefore allow a unique insight into a large organisation's email and spreadsheet behaviour.

At a high level, the findings of Dr Hermans' research mirror the findings of the YouGov study: [spreadsheets are used widely across business](#).

**THE GROUP OF 158 ENRON EMPLOYEES WERE EMAILING APPROXIMATELY 100 SPREADSHEETS PER DAY.**

10% of the 600,000 Enron emails studied were about [spreadsheets](#). Dr Hermans' analysis of the spreadsheets found that:

24% OF ENRON SPREADSHEETS WITH FORMULAS CONTAINED ERRORS.

There were 755 files with more than a hundred errors, with the maximum number of errors [in one file](#) being 83,273.

ON AVERAGE, ERRONEOUS CELLS IN SPREADSHEETS HAVE 9.6 OTHER FORMULAS DEPENDING ON THEM.

59% of unique formulas with errors had one or more dependent cells, which indicates that spreadsheet [errors can have an impact in other areas](#) of the spreadsheet.

22% OF FILES CONTAINED LONG CALCULATION CHAINS I.E. FORMULAS DEPEND ON A LONG STRING OF OTHER FORMULAS AS INPUT.

Dr Hermans notes: *"We know from previous work that it is exactly this that makes spreadsheets [hard to comprehend](#) ...it is difficult to get a global sense of the structure of the spreadsheet, which requires tracing the dependencies among the cells. Many users in our study described awkward pencil and paper procedures."*

OF THE 68,979 ENRON EMAILS WHICH DISCUSS SPREADSHEETS, 6% CONTAIN WORDS RELATED TO ERRORS.

The kinds of statements included in these emails include:

*"For yet another day we seem to be having problems including all the schedules in our EPE schedule sheet."*

*"The minimum runtime is the one that is garnering the most attention, but there is another parameter that would appear to be modelled incorrectly."*

*"This was the original problem around the pipe option spreadsheets which we discovered yesterday and the reason why the numbers did not match between the old and new processes."*

*"The EOL deal will error out in Spreadsheet – Natural Gas, therefore you won't see it erroring out under Sitara."*

**ACCORDING TO DR HERMANS:**

*"From the emails, we get the impression that spreadsheet errors are common."*



# 4. EXPERT WITNESS

Stephen Walker, Professor of Accounting at the University of Edinburgh Business School, and consulting editor of Accounting History Review, said:

"For several decades academic and business surveys have pointed to the issues surrounding the use of that most accessible and flexible aid to financial decision-making, the spreadsheet. The results of this important study alert us once again to some enduring concerns.

"They show that there continue to be limited controls around the use of spreadsheets and indicate the risks that numerous organisations take by not ensuring that they have systems in place to minimise the possibility of error. Academic and practitioner commentators have long emphasised the need to assess spreadsheet risk and for businesses to embed procedures which prevent and detect errors in spreadsheet modelling, formulas and data input.

**TRAINING IN THE USE OF SPREADSHEETS IS OFTEN PERCEIVED AS TIME CONSUMING, COSTLY AND UNNECESSARY.**

**ACADEMIC AND PRACTITIONER COMMENTATORS HAVE LONG EMPHASISED THE NEED TO ASSESS SPREADSHEET RISK.**

"Studies have also alerted us to the importance of adopting a systematic approach to the design, testing and review of spreadsheets and of building structures of accountability around their use. The current survey indicates that these issues are as pressing today as they have been in the past despite the many examples which suggest the potentially calamitous consequences of inaction.

*"The results of the survey also remind us of the educational challenge. Training in the use of spreadsheets is often perceived as time consuming, costly and unnecessary. But for large organisations in particular the consequences of making decisions based on error-ridden spreadsheets can be huge. It is clear that many spreadsheet users have a limited understanding of the fundamental concepts that underpin them.*

"They have limited awareness of how to build spreadsheets that minimise error and have the capacity to self-audit. The widespread use of the spreadsheet in diverse modern-day organisations means that this educational challenge should be addressed at various levels. It has long been argued that businesses need to invest in more comprehensive training and raise awareness of the risks surrounding spreadsheets.

"Universities and professional bodies should also reassess the extent to which their curricula provides adequate instruction in the use and application of this extraordinarily powerful but risk-laden tool."

# CAPITALISM'S DIRTY SECRET HAS BEEN REVEALED, **NOW IT'S TIME TO ACT.**

*We commissioned this YouGov study to obtain a clearer picture of the true state of spreadsheet use and abuse across the corporate world. We knew from first hand experience that the situation was not good, but even we were surprised by some of the findings in this research.*

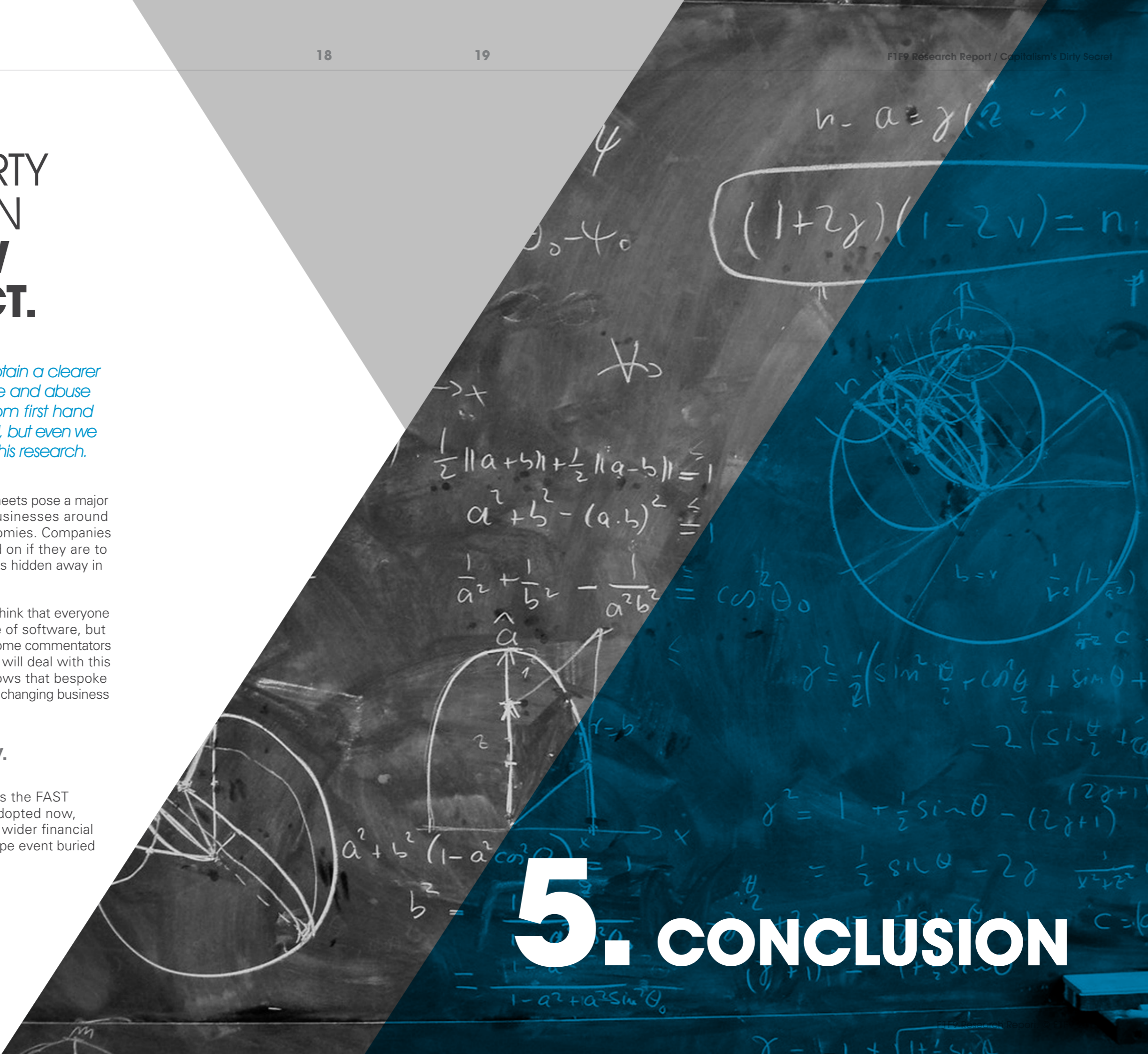
Poorly constructed and managed financial spreadsheets pose a major threat to the financial health of thousands of businesses around the world, and with it the success of wider economies. Companies must act now to confront these challenges head on if they are to reduce their exposure to the massive financial risks hidden away in spreadsheets that simply aren't fit for purpose.

Perhaps because Excel software is ubiquitous we think that everyone can use it? Wrong. It's an incredibly flexible piece of software, but therein lies the problem, a lack of standardisation. Some commentators suggest a killer app is just around the corner that will deal with this issue once and for all — it won't. Experience shows that bespoke applications are never flexible enough for the rapidly changing business environments in which we all operate.

## Spreadsheets are here to stay.

Industry-wide standards of best practice, such as the FAST Standard, are the key to success and must be adopted now, before yet another company, sector or even the wider financial system is undone by a catastrophic Black Swan-type event buried deep inside a broken spreadsheet.

# 5. CONCLUSION



# A. APPENDIX A: 20 PRINCIPLES FOR GOOD SPREADSHEET PRACTICE

In 2014 the Institute of Chartered Accountants in England and Wales published their 20 Principles for Good Spreadsheet Practice.

These principles can go a long way in reducing risk in spreadsheet models. ICAEW 20 principles in summary:

## THE SPREADSHEET'S BUSINESS ENVIRONMENT

### ICAEW Principle

### Why It Matters

1.

**DETERMINE WHAT ROLE SPREADSHEETS PLAY IN YOUR BUSINESS, AND PLAN YOUR SPREADSHEET STANDARDS AND PROCESSES ACCORDINGLY.**

The YouGov research shows that spreadsheet use is not uniform across business.

For example, while 70% of large businesses said they use spreadsheets for budgeting and/or forecasting, this was only true of 43% of small businesses.

In the hospitality and leisure industry 29% of companies reported not using spreadsheets at all. This was only true in 4% of business in finance and accounting.

2.

**ADOPT A STANDARD FOR YOUR ORGANISATION AND STICK TO IT.**

A standardised approach to modelling ensures that models can be shared more easily between individuals. This helps increase productivity and reduce modelling risk.

**Modelling Standardisation Resources:**

The FAST Standard is an open industry standard supported by a number of leading accountancy and financial companies. The FAST Standard has been recognised by the ICAEW as being compliant with their 20 principles.

How to standardise modelling is a free F1F9 ebook that sets out some of the lessons we've learned in standardising modelling in our own business.

The Financial Modelling Handbook is a crowd-sourced guide to good spreadsheet modelling practice, based on the FAST Standard. All the guides are free to download.

3.

**ENSURE THAT EVERYONE INVOLVED IN THE CREATION OR USE OF SPREADSHEETS HAS AN APPROPRIATE LEVEL OF KNOWLEDGE AND COMPETENCE.**

The YouGov research indicated that compared to nationwide benchmarks on training spending, companies are under-investing in spreadsheet training.

In 59% of companies, nothing had been invested in spreadsheet training in the last 12 months. Only 15% of companies in finance and accounting spent more than £5,000 across the whole company.

4.

**WORK COLLABORATIVELY, SHARE OWNERSHIP, PEER REVIEW.**

Only 1% of large British businesses say that key financial decisions are never supported by spreadsheets. It is therefore critical that it is possible for individuals to share spreadsheets and work collaboratively on them. Adopting spreadsheet standards and implementing a formal peer review process helps enormously with this.

# DESIGNING & BUILDING YOUR SPREADSHEET

## ICAEW Principle

## Why It Matters

**5.**  
**BEFORE STARTING, SATISFY YOURSELF THAT A SPREADSHEET IS THE APPROPRIATE TOOL FOR THE JOB.**

There are many software applications that may be a better choice for larger scale analytics and data processing.

That said, even where database applications are used, spreadsheets are very often the glue between different systems.

When companies understand the risks of spreadsheets the temptation is often to try and prevent their use. In our experience this just drives the problem “underground”.

**6.**  
**IDENTIFY THE AUDIENCE. IF A SPREADSHEET IS INTENDED TO BE UNDERSTOOD AND USED BY OTHERS, THE DESIGN SHOULD FACILITATE THIS.**

Understand the different requirements between a model user and a model builder.

There are a number of simple techniques that can greatly enhance the “readability” of spreadsheets.

F1F9 offer a [free online introductory course](#) on some of these techniques.

**7.**  
**INCLUDE AN ‘ABOUT’ OR ‘WELCOME’ SHEET TO DOCUMENT THE SPREADSHEET.**

It is useful to include as much documentation within the spreadsheet as possible to assist users in understanding how to read it.

At F1F9 we include a model flow diagram showing how different parts of the model interface with each other.

**8.**  
**DESIGN FOR LONGEVITY.**

Spreadsheets make it easy to perform “quick and dirty” calculations and to quickly hack together a rough analysis. In our experience spreadsheets last much longer than anybody expects them to and can end up being relied upon by multiple departments within a company.

**9.**  
**FOCUS ON THE REQUIRED OUTPUTS.**

A spreadsheet model always exists for a purpose. The design should make it clear what that purpose is. As Stephen Covey said in his 7 Habits book, “start with the end in mind”.

**10.**  
**SEPARATE AND CLEARLY IDENTIFY INPUTS, WORKINGS AND OUTPUTS.**

This is a simple recommendation, however it has a significant impact on spreadsheet risk. Understanding where to find inputs, workings and outputs makes model review easier.

## ICAEW Principle

## Why It Matters

**11.**  
**BE CONSISTENT IN STRUCTURE.**

Consistent structure across worksheets and within worksheets in a spreadsheet helps to reduce chaos and therefore risk.

This [financial modelling handbook guide](#) gives a primer on model structure applying the FAST Standard.

**12.**  
**BE CONSISTENT IN THE USE OF FORMULAE.**

Consistency sometimes applies across rows, sometimes down columns. Either way, it is important that formulae are consistent across a series.

**13.**  
**KEEP FORMULAE SHORT AND SIMPLE.**

Long, complex formulae are a key cause of models being difficult to read and understand. Formulae can be made simple by breaking calculations into smaller steps, each step being clearer to read and understand. This can have the downside of increasing the number of rows, but the benefits such as simplicity and transparency outweigh the downside.

**14.**  
**NEVER EMBED IN A FORMULA ANYTHING THAT MIGHT CHANGE OR NEED TO BE CHANGED.**

If inputs are embedded into calculations it makes it harder to update and understand what is driving models. It also adds to inefficiency should a value change and need to be updated. According Felienne Hermans’ research, 28% of Enron spreadsheets had inputs embedded into formulae.

**15.**  
**PERFORM A CALCULATION ONCE AND THEN REFER BACK TO THAT CALCULATION.**

Performing the same calculation multiple times in a spreadsheet model increases the risk of error and inefficiency.

**16.**  
**AVOID USING ADVANCED FEATURES WHERE SIMPLER FEATURES COULD ACHIEVE THE SAME RESULT.**

While simpler function and features do not necessarily result in clearer models, unnecessary use of complex functions should be avoided.

Think twice before using VBA coding as this tends to add to the “black box” nature of the spreadsheet model.

# SPREADSHEET RISKS & CONTROLS

## ICAEW Principle

## Why It Matters

17.

**HAVE A SYSTEM OF BACKUP AND VERSION CONTROL, WHICH SHOULD BE APPLIED CONSISTENTLY WITHIN AN ORGANISATION.**

One of the key risks around spreadsheets is that of version control. Combined with spreadsheets being emailed between multiple users, this can cause significant risk. Where spreadsheets are not held in a cloud based collaboration platform that automates version control, strict version control protocols are required.

18.

**RIGOROUSLY TEST THE WORKBOOK.**

Very often analysts using spreadsheets are under significant commercial and time pressure. There is very often little time in the spreadsheet building process for reviewing and testing. Businesses should think of building spreadsheet models as being more like software engineering.

Understand upfront what your internal process is for testing and reviewing your model.

19.

**BUILD IN CHECKS, CONTROLS AND ALERTS FROM THE OUTSET AND DURING THE COURSE OF SPREADSHEET DESIGN.**

Check and alerts can help the spreadsheet builder to check that key inputs and outputs are as expected. For example, a balance sheet check, or a number of values that should add up to a specific number.

20.

**PROTECT PARTS OF THE WORKBOOK THAT ARE NOT SUPPOSED TO BE CHANGED BY USERS.**

This can help to avoid unintentional errors being introduced by users who perhaps did not build the spreadsheet. Alternatively, use colour coding to identify parts that should not change.

# B.

## APPENDIX B: METHODOLOGY

All figures, unless otherwise stated, are from YouGov Plc.

Total sample size was 1,277 senior decision makers in businesses of any size. Fieldwork was undertaken between 9th - 16th February 2015. The survey was carried out online. The figures have been weighted and are representative of business size.

# C.

## APPENDIX C: SOURCES

### GB Private Sector Turnover

<https://www.gov.uk/government/statistics/business-population-estimates-2014>

### UK Manufacturing Output

<http://ons.gov.uk/ons/rel/prodcom/prodcom-intermediate-results-and-final-results-for-previous-year/intermediate-results-2013-and-final-results-2012/stb-prod-2013.html>

### UK Business Investment

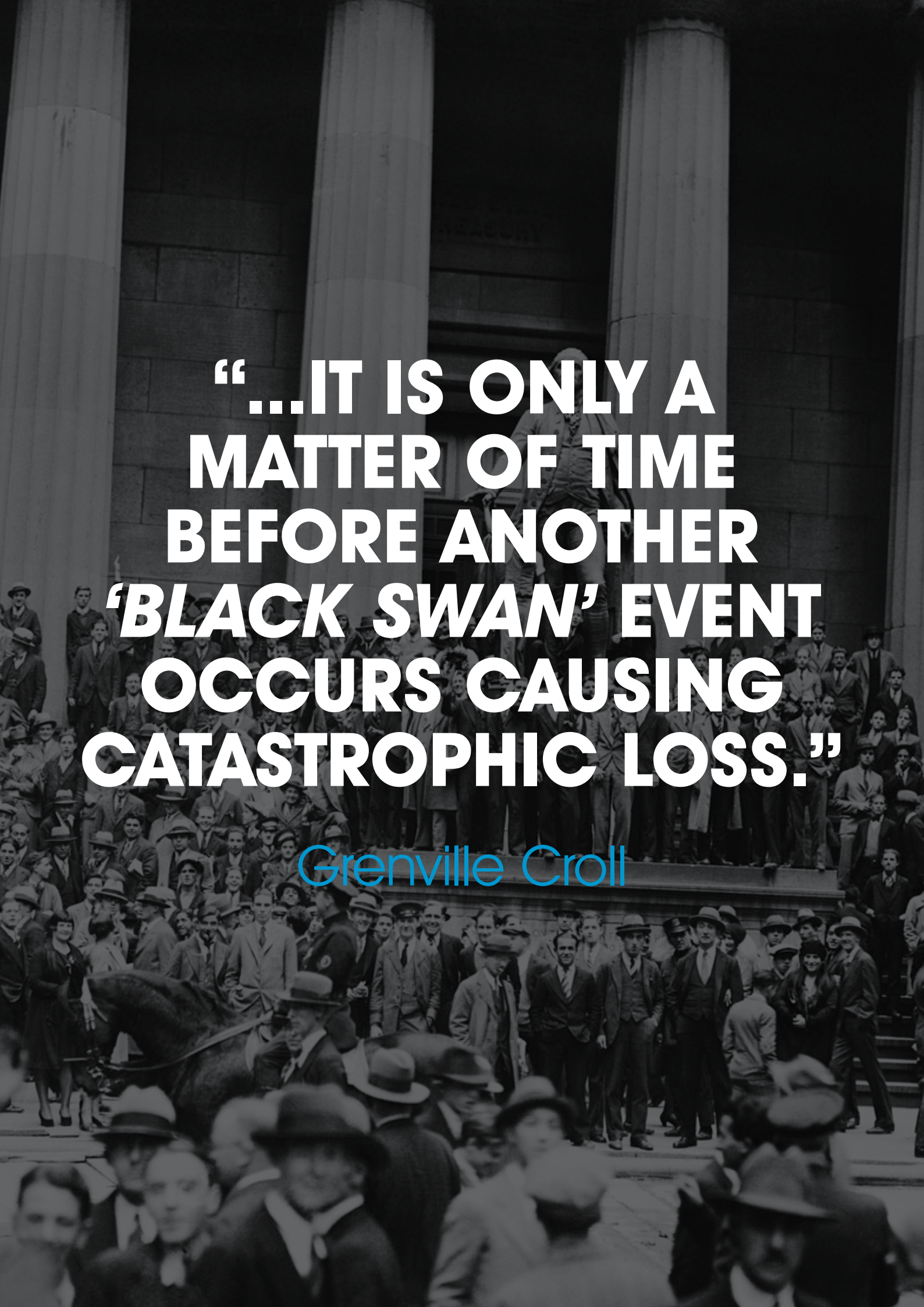
<http://www.ons.gov.uk/ons/rel/bus-invest/business-investment/q3-2014-revised-results/stb-bus-invest-q3-2014-revised-results.html#tab-Summary-Tables>

### UK Retail Sales

<http://www.ons.gov.uk/ons/rel/rsi/retail-sales/january-2015/tsd-retail-sales-january-2015.html>

### UK Training Spend Per Employee

[https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/303495/ukces-employer-skills-survey-13-executive-summary-81.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/303495/ukces-employer-skills-survey-13-executive-summary-81.pdf)



**“...IT IS ONLY A  
MATTER OF TIME  
BEFORE ANOTHER  
‘BLACK SWAN’ EVENT  
OCCURS CAUSING  
CATASTROPHIC LOSS.”**

Grenville Croll

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**F1F9 RESEARCH REPORT**

Empirical research and insight into the use of spreadsheets  
in business, industry and beyond.

**F1F9 builds and maintains financial models used by leading corporates, advisors, banks and funds.**

**We also train our clients to build better models themselves through courses delivered worldwide.**

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**F1F9**