

Article

Management practices and innovation, Great Britain

Using firm-level survey data, we explore the relationship between management practices and innovative activity, including formal R&D.

Contact:
Jakob Schneebacher
mes@ons.gov.uk
+44 3000 682563

Release date:
23 August 2021

Next release:
To be announced

Table of contents

1. [Main points](#)
2. [The role of good management in innovation](#)
3. [Better-managed firms are more likely to engage in research and development \(R&D\)](#)
4. [Better-managed firms spend more on research and development \(R&D\)](#)
5. [Product and process innovation follow similar patterns](#)
6. [No clear relationship exists between self-reported innovative turnover and management](#)
7. [Better management is associated with higher research and development \(R&D\) labour productivity returns](#)
8. [Management practices and innovation data](#)
9. [Glossary](#)
10. [Data sources and quality](#)
11. [Future developments](#)
12. [Authors](#)
13. [Related links](#)

1 . Main points

- Across all industries, better-managed firms are significantly more likely to engage in research and development (R&D) than their peers.
- Better-managed firms tend to spend significantly more on R&D and innovative activity than comparable, less-well-managed firms.
- The type of R&D activity (product versus process and the source of funding) is not significantly different for better-managed firms once we account for compositional differences.
- The relationship between the reported share of innovative turnover and management scores is volatile and dependent on the choice of definition.
- Better-managed firms see higher labour productivity per pound of R&D spending than comparable, less-well-managed firms.

2 . The role of good management in innovation

[Management practices](#) (PDF, 0.99KB) are robustly associated with many measures of firm success across many studies and settings, from survival to turnover and productivity. [Randomised experiments](#) (PDF, 1.09MB) suggest that a large part of this link may be causal. In the UK too, we find that [firms differ significantly](#) in their management practices, that better-managed firms are [more productive](#) and were in some ways [better able to adapt to the coronavirus \(COVID-19\) pandemic](#).

The role of good management in spurring innovation is less well explored. Academic studies have highlighted the role of [competitive factors](#) (PDF, 1.32MB), [human capital](#) (PDF, 461KB), [access to basic research](#) and [well-targeted government policies](#). Yet these inputs need to be combined to have an impact, and corporate researchers need to be both directed to the right challenges and well-motivated.

Our article shows that, in Great Britain, better-managed firms are more likely to engage in research and development (R&D) and wider innovation spending, and are more likely to spend more on innovative activity than comparable firms. Better-managed firms possibly see higher returns to their spending, and are ultimately more productive.

For example, moving a firm from the median management practices score to the top 25% has roughly the same effect on a firm's probability of engaging in R&D (known as "R&D active") as moving it from domestic to foreign ownership.

To estimate the relationship between management practices and innovation at the firm level, we combine data on management practices from the Management and Expectations Survey (MES) with data on R&D expenditures from the Business Enterprise Research and Development (BERD) survey and data on broader forms of innovation expenditure and activity from the UK Innovation Survey (UKIS). The data cover responses from firms in 2016, which is the latest year for which we have data from all three sources. We describe the data and caveats arising from this approach in Section 10. Our other publications provide more detail on [MES](#), [BERD](#) and [UKIS](#).

For most of this article, we use the overall management practices score from MES to compare management practices across businesses in Great Britain. It measures four dimensions of good management: continuous improvement, the use of key performance indicators (KPIs), target setting and employment practices relating to promotion, training, and employee underperformance. The management practices score runs from 0 to 1. A business with a score of 0 has failed to implement any formal management practices. A score of 1 describes a business that continuously reviews its processes to minimise future problems, tracks performance indicators and targets across the firm and has adopted merit-based practices to hire, promote and train employees.

3 . Better-managed firms are more likely to engage in research and development (R&D)

Firms that engage in research and development (R&D active firms) have, on average, higher management practices scores than non-R&D active firms. As can be seen in Figure 1, this is not driven by a particular part of the distribution. In fact the entire distribution of R&D active firms lies to the right of the distribution of non-R&D active firms. The population mean of management practices score is close to the mean of non-R&D active firms. This reflects the fact that most firms are not R&D active.

Figure 1: Firms that do research and development tend to have more structured management practices than other firms

Kernel density distribution of management practices scores, split by firms who are R&D active and those who have never conducted R&D (with whole MES sample for comparison), Great Britain, 2016

Notes:

1. Kernel density bandwidth size = 0.5.
2. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
3. For further information on "R&D active" status please see the glossary.

[Download the data](#)

This overall pattern is reflected within subcategories of firms too. The kernel density charts in Figure 2 show that R&D active firms have higher management practices scores than non-R&D active firms for all eight industry categories along the entire distribution of firms.

Figure 2: Across all industries, firms who conduct R&D on average have better management practices than firms who do not

Kernel density distribution of management practices scores, split by firms who are R&D active and firms who are non-R&D active for eight industry groupings, Great Britain, 2016

Notes:

1. Kernel density bandwidth size = 0.5.
2. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
3. For further information on "R&D active" status please see the glossary.
4. Industry grouping composition can be found in the glossary.

[Download the data](#)

However, better-managed and less-well-managed firms differ from each other [along other dimensions too](#) (PDF, 604 KB). To investigate the degree to which these differences in R&D rates are in fact driven by management practices, we progressively include a number of other observable firm characteristics to isolate the direct effect of management.

Our baseline controls include firm employment size and industry to a division (2-digit) level according to the Standard Industrial Classification (SIC) 2007. The full set of control variables additionally includes the age of the firm, ownership structure and the primary geographical location of the firm. These variables are widely used in the [management practices](#) (PDF, 208 KB) literature and predict management practices quite well.

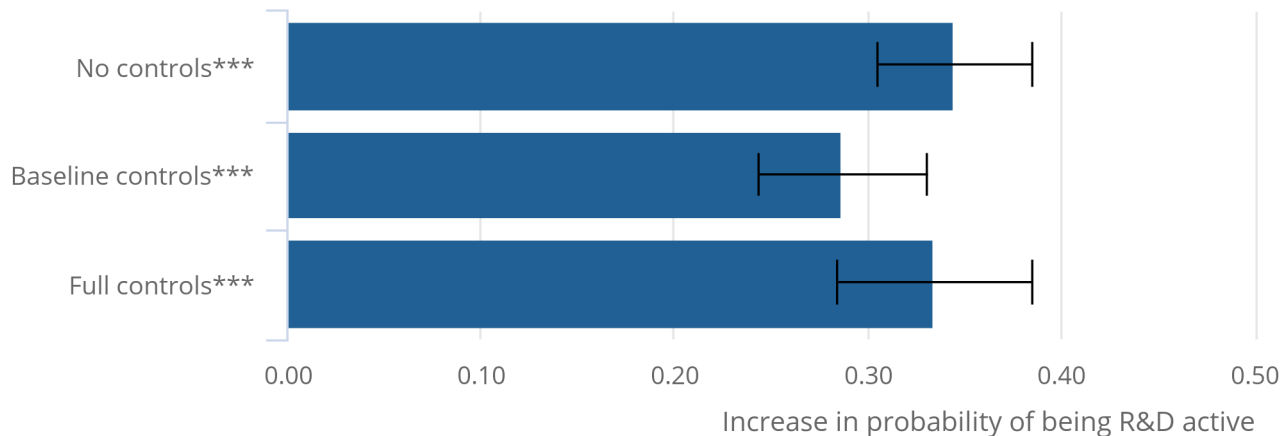
Figure 3 shows that, regardless of the controls included, management practices are positively, significantly and robustly correlated with the likelihood of conducting R&D. An increase in a firm's management practices score of 0.1 is correlated with an increase in their probability of conducting R&D by around three percentage points, all else equal. To put this into perspective, if a firm at the median of the management practices score distribution were to increase their management practices score by 0.1, it would find itself at the 75th percentile instead.

Figure 3: Better-managed firms are significantly more likely to engage in R&D than less-well-managed firms

Ordinary Least Squares (OLS) regression coefficients of management practices score on the likelihood of conducting R&D under various econometric specifications, Great Britain, 2016

Figure 3: Better-managed firms are significantly more likely to engage in R&D than less-well-managed firms

Ordinary Least Squares (OLS) regression coefficients of management practices score on the likelihood of conducting R&D under various econometric specifications, Great Britain, 2016



Source: Office for National Statistics – Management and Expectations Survey and Business Enterprise Research and Development Survey

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Baseline controls include firm employment size and industry breakdown at the two digit (division) level, based on the 2007 Standard Industrial Classification. Full controls include baseline controls plus firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
4. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
5. Outcome variable R&D activity status in BERD. For further information of "R&D active" status please see the glossary.

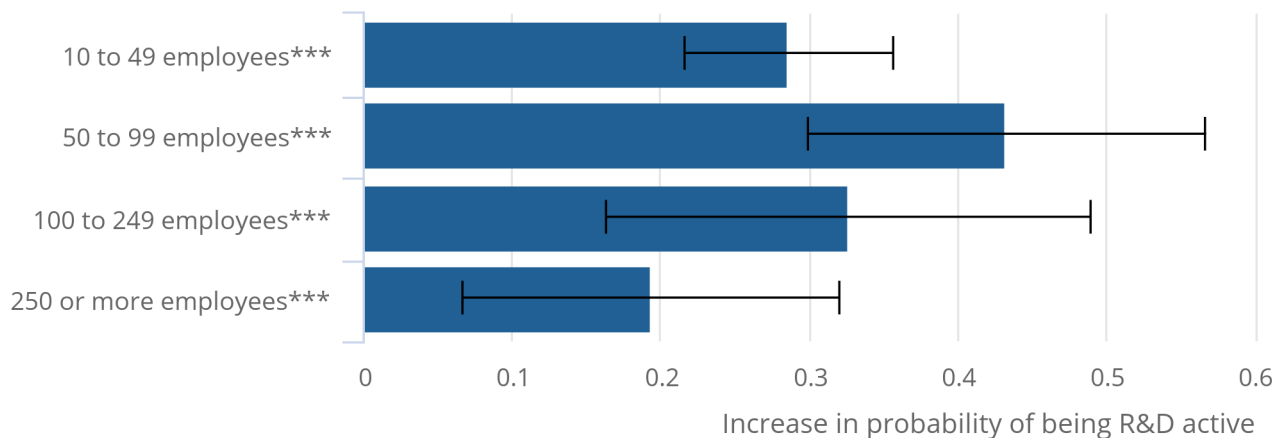
The same overall pattern holds across different types of firms as well. Figure 4 shows the relationship for different firm size categories, again controlling for observable firm characteristics. The effect of management practices is similar in size, magnitude and statistical significance across all size bands.

Figure 4: Across all size bands, better-managed firms are more likely to conduct research and development

OLS regression coefficients of management practices score on the likelihood of conducting R&D, by size band, Great Britain, 2016

Figure 4: Across all size bands, better-managed firms are more likely to conduct research and development

OLS regression coefficients of management practices score on the likelihood of conducting R&D, by size band, Great Britain, 2016



Source: Office for National Statistics – Management and Expectations Survey and Business Enterprise Research and Development Survey

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
4. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
5. Outcome variable R&D activity status in BERD. For further information of "R&D active" status please see the glossary.

The industry breakdown in Figure 5a reveals interesting variation in the overall effect. Management practices seem to be most highly correlated with R&D activity in non-manufacturing production and real estate, and least highly correlated in transport, communication and other services. Business services and manufacturing, which account for the bulk of R&D spending (shown in Figure 5b), sit in the middle of the distribution. For a firm in those two industries, moving from the median of the management practices distribution to the 75th percentile is associated with about a four-percentage point higher probability of engaging in R&D activity, all else equal.

Figure 5: Across industries, the importance of management practices for R&D varies

OLS regression coefficients of management practices score on the likelihood of conducting R&D by eight industry groups with proportion of total R&D spend, Great Britain, 2016

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
4. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
5. Outcome variable R&D activity status in BERD. For further information of "R&D active" status please see the glossary.
6. Industry grouping composition can be found in the glossary.
7. Proportion of total R&D spend calculated from Business Enterprise Research and Development survey data collating expenditure on R&D performed in UK businesses by SIC division. For more information see our previous release.
8. Total R&D spend is the total of R&D spend in 2016 for the eight industry groupings. These exclude R&D expenditure in section A (Agriculture, forestry and fishing) and sections K and L (Financial and insurance activities)

[Download the data](#)

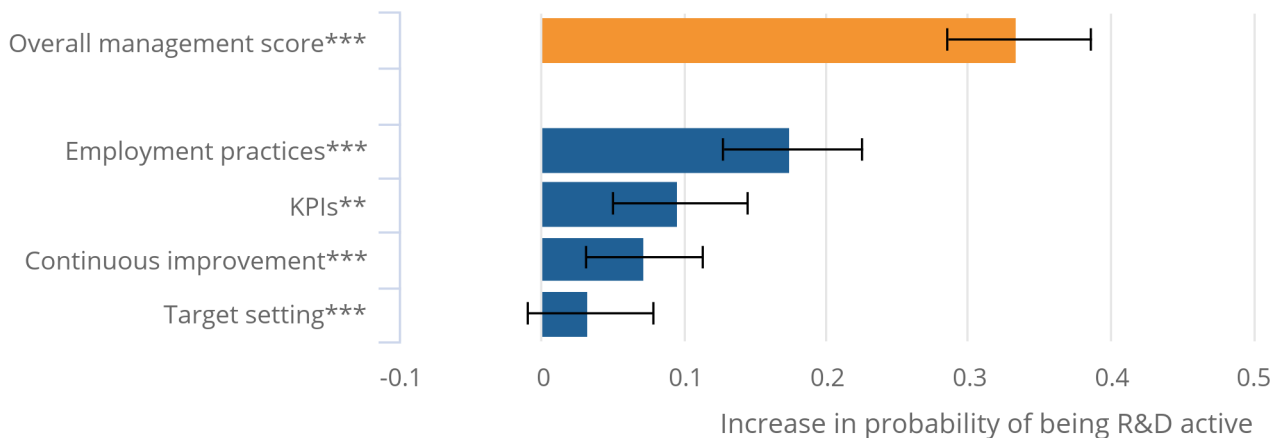
The management practices score encompasses many different organisational practices. Of course, this overall correlation could be driven by a particular set of practices alone. Figure 6 therefore shows the results of a regression that includes the four categories of the overall score separately, along with our full set of control variables. All categories apart from targets appear to contribute independently to a firm's likelihood of engaging in R&D activity, with employment practices perhaps the most statistically and quantitatively significant. The effect of targets is also positive, but statistically indistinguishable from zero.

Figure 6: Employment practices, Key Performance Indicators and continuous improvement are positively associated with the likelihood of conducting R&D

OLS regression coefficients for management practice categories on the likelihood of conducting R&D with full controls, Great Britain, 2016

Figure 6: Employment practices, Key Performance Indicators and continuous improvement are positively associated with the likelihood of conducting R&D

OLS regression coefficients for management practice categories on the likelihood of conducting R&D with full controls, Great Britain, 2016



Source: Office for National Statistics – Management and Expectations Survey and Business Enterprise Research and Development Survey

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
4. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
5. Outcome variable R&D activity status in BERD. For further information of "R&D active" status please see the glossary.
6. Overall management score from baseline regression included for reference only.

4 . Better-managed firms spend more on research and development (R&D)

Among the firms that do decide to engage in research and development (R&D), better-managed firms invest more intensely. Figure 7 shows the effect of the management practices score on the two different measures of innovation expenditure, controlling for firm observables. The effect of management practices is positive and significant for both R&D expenditure in the Business Enterprise Research and Development (BERD) data (a more focused measure of formal R&D, in line with international definitions) and for innovation expenditure from the UK Innovation Survey (UKIS) (a broader measure of innovation activity that goes beyond a narrow definition of R&D).

Figure 7: The relationship between management practices and innovation is similar for different definitions of innovative activity

OLS regression coefficients for determinants of innovative spending from regressions using MES and BERD and MES and UKIS linked samples, 2016

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. The dependent variable is the logarithm of R&D Expenditure (BERD) and Innovative Expenditure (UKIS), respectively.
4. A more detailed explanation of what each R&D expenditure source contains is available in the glossary.
5. We have included industry and location fixed effects. The industry fixed effects are at the two digit (division) level, based on the 2007 Standard Industrial Classification. Location fixed effects are the primary location of the reporting unit
6. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
7. For information on the data coverage of our matched Management and Expectations Survey (MES) and UK Innovation Survey (UKIS) sample, see our Data sources and quality section.

[Download the data](#)

Figure 8 compares the relationship between management practices and innovation for the full samples of matched firms from BERD and UKIS, with the same coefficients obtained when splitting the sample into production and services, and into manufacturing and non-manufacturing sectors. Given the small sample sizes, these results are necessarily somewhat noisier but show the same overall pattern. When using the BERD data, the significance of the relationship disappears for services and non-manufacturing sectors. This could be because of either the small number of firms in this cut of the data, or because the types of innovative activity in which service and non-manufacturing businesses engage are less likely to fall under the strict definition of R&D.

Figure 8: The relationship between management practices and innovative expenditure broadly holds for different industry breakdowns

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. The dependent variable is the logarithm of R&D Expenditure (BERD) and Innovative Expenditure (UKIS), respectively.
4. A more detailed explanation of what each R&D expenditure source contains is available in the glossary.
5. Industry grouping composition can be found in the glossary.
6. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
7. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, and our MES and UK Innovation Survey (UKIS) sample, see our Data sources and quality section.

[Download the data](#)

5 . Product and process innovation follow similar patterns

Better-managed firms engage in more research and development (R&D) and innovative activity, but do they engage in different types of innovation? We looked at the distinction between product and process innovation and the sources of funding underlying innovative activity.

A reasonable question to ask is whether management practices matter differently for product innovation (the introduction of new products) and process innovation (significant improvements to the way in which existing products are produced). In fact, Figure 9a shows that the distribution of management practices is significantly different for product and process innovators; process innovators are similar to firms that do not innovate. However, this is merely a compositional effect: when we adjust for the industry, region, and other observables of the firm, product and process innovation are similarly related to good management practices (see Figure 9b).

Figure 9: Aggregate differences between process and product innovators are due to compositional factors

Kernel densities and OLS regression results for different types of innovative activity, 2016

Notes:

1. Kernel density bandwidth size = 0.5.
2. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
3. Figures are rounded to 3 significant figures.
4. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
5. "Product innovators" refers to business's who introduced new or significantly improved goods or services.
6. "Process innovators" refers to business's who introduced new or significantly improved processes for producing or supplying goods or services.
7. For information on the data coverage of our matched Management and Expectations Survey (MES) and UK Innovation Survey (UKIS) sample, see our Data sources and quality section.

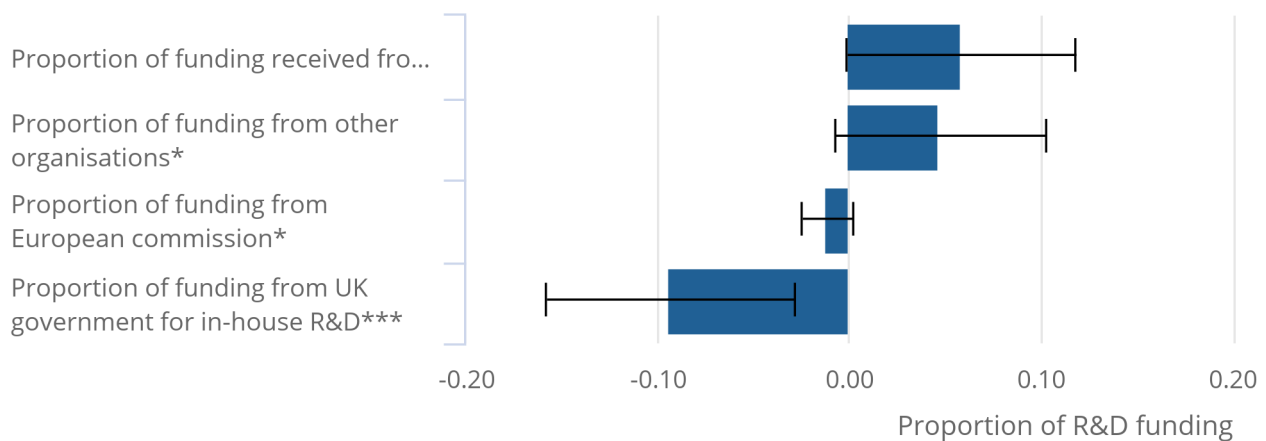
Management may also matter for how firms finance innovative activity, although the direction of the effect is potentially ambiguous. Better-managed firms might be more able to apply for government grants, or they might instead be able to identify commercial applications more easily and therefore use private-sector sources instead. In our sample, Figure 10 shows that better-managed firms are more likely to rely on private-sector sources to fund their innovative activity. However, these results depend somewhat on how funding sources are grouped and therefore need to be explored further.

Figure 10: Better-managed firms are slightly less likely to rely on UK government funding for R&D

OLS regression coefficients of management practices score for different sources of R&D funding as a proportion of total funding with full controls, 2016

Figure 10: Better-managed firms are slightly less likely to rely on UK government funding for R&D

OLS regression coefficients of management practices score for different sources of R&D funding as a proportion of total funding with full controls, 2016



Source: Office for National Statistics – Management and Expectations Survey and Business Enterprise Research and Development Survey

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Regressions are run as seemingly unrelated regressions.
4. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
5. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
6. Proportions are calculated for each source of self-reported in-house R&D funding relative to total funding received.
7. Funding from other organisations includes any funding which was not received from UK government, private organisations, European commission, other overseas organisation or from own funds for in-house R&D.

6 . No clear relationship exists between self-reported innovative turnover and management

The evidence on the relationship between management scores and a firm's share of innovative turnover is more mixed. Figure 11 shows the coefficients from two sets of regressions of innovative turnover on management practices and other firm observables. The regressions differ in their definition of innovative activity, and whether they control for research and development (R&D) expenditure. Not controlling for R&D expenditure allows management to be correlated with innovative turnover both directly and by influencing the amount of R&D expenditure. There is weak evidence that better management scores are correlated with a firm's ability to catch up with innovative products developed by other firms. Overall, however, coefficients change size, significance and even sign across regressions.

However, it is important to note that innovative turnover is self-reported and, given the challenges of assigning turnover to particular investments, may well be an imprecise measure of true innovative outcomes. Coefficients on other variables in these regressions are equally unstable, suggesting that this may be the case.

Figure 11: The self-reported share of innovative turnover does not seem to correlate with management practices

OLS regression coefficients of management practices score for different innovative turnover definitions, 2016

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
4. "Any innovative activity" is the sum of the 3 categories in the table and represents the total proportion of turnover from changed goods or services.
5. For information on the data coverage of our matched Management and Expectations Survey (MES) and UK Innovation Survey (UKIS) sample, see our Data sources and quality section.

[Download the data](#)

7 . Better management is associated with higher research and development (R&D) labour productivity returns

Does the increased research and development (R&D) activity and effectiveness ultimately correlate with higher labour productivity for better-managed firms? Previous work has separately found a positive relationship between [management practices and productivity](#), and between [R&D spending and productivity](#). However, as we have shown in this article, management practices and R&D activity are in turn positively linked. In Figure 12a we therefore show that management practices are independently correlated with labour productivity even once we control for any indirect relationship through R&D spending.

Figure 12: Good management practices are correlated with more productive R&D

OLS regression coefficients of labour productivity on R&D expenditure, management practices and full controls for both linked samples with and without interactions and bar chart showing heterogeneity in effects size by firm management score, 2016

Notes:

1. Stars after coefficients denote significance at conventional significance levels: * $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$.
2. Figures are rounded to 3 significant figures.
3. Controls included in regressions are firm employment size, industry at the two digit (division) level, based on the 2007 Standard Industrial Classification, firm age, ownership structure (family ownership, family management and foreign ownership) and the primary geographical location of the reporting unit.
4. A more detailed explanation of what each R&D expenditure source contains is available in the glossary.
5. Labour productivity is defined as aGVA in ABS data divided by employment. In our analysis we use the log of this value. For more details please see the Data section.
6. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section
7. For information on the data coverage of our matched Management and Expectations Survey (MES) and UK Innovation Survey (UKIS) sample, see our Data sources and quality section.

[Download the data](#)

Finally, Figure 12b displays how much more productive a given amount of R&D expenditure is in better-managed firms compared with less-well-managed firms. When we compare two otherwise identical firms with identical R&D expenditures at the 25th and 75th percentile of the management practices distribution, the better-managed firm will see roughly twice as strong a correlation with labour productivity compared with its less-well-managed peer. This interaction effect between R&D therefore appears both quantitatively and statistically significant. However, when using the Management and Expectations Survey (MES) data linked with the UK Innovation Survey (UKIS) to investigate this mechanism for a broader measure of innovative activity instead of strict R&D, the coefficient shrinks in size and loses statistical significance. Clearly, a better understanding of these channels is needed.

8 . Management practices and innovation data

[Management practices and innovation](#)

Dataset | Released 23 August 2021

Regression analysis underlying the publication “Management practices and innovation”. Firm-level data relating to 2016. Includes regression table outputs displaying the relationship between management practices and research and development (R&D), innovative expenditure and labour productivity in matched samples across various econometric specifications.

9 . Glossary

Industry and region fixed effects

We use regression analysis to compare like-for-like firms as much as possible. By including fixed effects, we are able to control for the average differences across industries or regions in both observable and unobservable explanatory variables. We can therefore compare observations that are much more alike.

Innovative Expenditure

Innovative expenditure from the UK Innovation Survey (UKIS) is calculated as the sum of internal research and development (R&D), acquisition of R&D, acquisition of advanced machinery, equipment and software, acquisition of existing knowledge, training for innovative activities, all forms of design, and market introduction of innovations. It is important to distinguish R&D expenditure and broader innovative expenditure, as we do in this article.

Management practices score

The overall management practices score (known as "management score") is an average of the scores along the four dimensions of management practices measured: continuous improvement, key performance indicators (KPIs), targets and employment practices.

Management and Expectations Survey (MES) Industry Groupings

MES uses a custom 8-industry breakdown. Non-manufacturing production equals standard industrial classification (SIC) sections B (Mining and quarrying), D (Electricity, gas, steam and air conditioning supply) and E (Water supply; sewerage, waste management and remediation activities). Manufacturing equals section C (Manufacturing). Construction equals section F (Construction). Retail, wholesale, accommodation and food services equals sections G (Wholesale and retail trade; repair of motor vehicles and motorcycles) and I (Accommodation and food service activities). Transport, storage, and communication services equals sections H (Transportation and storage) and J (Information and communication). Business services equals sections M (Professional, scientific and technical activities) and N (Administrative and support service activities). Real estate equals section L (Real estate). Other services equals sections P (Education), Q (Human health and social work activities), R (Arts, entertainment and recreation) and S (Other service activities).

Additionally, for Figure 8, we used two further industry breakdowns (production and services and manufacturing and non-manufacturing, respectively). Production contains sections B to F and services contains sections G to S. Manufacturing contains firms in section C (Manufacturing) and Non-manufacturing contains all other sections.

R&D active status

"R&D active" refers to any business which has entered the Business Enterprise Research and Development (BERD) survey database in 2015, 2016 or 2017, and "non-R&D active" are those who have not. For a firm to be recognised as conducting R&D at one point in time, that is, to be "R&D active", the firm's activity must be recognised as novel, creative, uncertain, systematic and transferable or reproducible according to the Organisation for Economic Co-operation and Development (OECD) [Frascati Manual Methodology](#).

Research and development (R&D) expenditure

The Business Enterprise Research and Development (BERD) expenditure is defined as the sum of internal and external expenditure on R&D. Internal R&D is comprised of salaries of staff employed for R&D tasks, total in-house non-capital expenditure for R&D and total capital expenditure for R&D. Purchased or external R&D expenditure is the sum of R&D purchased in the UK and outside the UK. These expenditures are in line with the Frascati manual for calculating internationally comparable R&D estimates.

10 . Data sources and quality

This section provides additional detail about the four datasets used in this study: the Management and Expectations Survey (MES), the Business Enterprise Research and Development Survey (BERD), the UK Innovation Survey (UKIS) and the Annual Business Survey (ABS). Observations are matched across surveys using their unique Reporting Unit (RU) number. The analysis is then conducted at the RU level. For most smaller firms this corresponds to the firm level; for larger businesses the RU sits between the firm level and the local establishment level. Since we are using matched samples, we rely on sufficient coverage in two or more underlying surveys. Our MES-BERD matched sample therefore excludes firms in section A (Agriculture, forestry and fishing) and section K (Financial and insurance activities). Our MES-UKIS matched sample excludes firms in section A (Agriculture, forestry and fishing), section K (Financial and insurance activities) and sections O to U (Government and Other Services).

Management and Expectations Survey (MES)

The MES attempts to measure the extent to which firms use formal management practices. MES was carried out in 2017 to collect information on management practices of businesses in Great Britain in 2016. MES was a voluntary postal survey, sent to approximately 25,000 firms. These businesses were drawn from the ABS, with employment of 10 or more and covering a bespoke mix of production and services industries. The MES sample was stratified by employment size, industry and region.

The MES data provides a measure of management practices across four dimensions. These are: continuous improvement (how well a firm monitors and adapts to emerging problems), the use of key performance indicators (KPIs, the number of KPIs and how often they are reviewed), the setting, application and review of appropriate business targets, and employment practices relating to training, hiring and promotions. A simple average of these dimensions places each sampled firm on a 0 to 1 scale of management practices, with 0 relating to no structured management practices and a score of 1 for firms which follow the best management practices across all four categories. Since MES excludes Northern Ireland and certain sectors, it is not representative of the whole UK economy.

Business Enterprise Research and Development (BERD)

The BERD survey collects data on the extent to which a company conducts formal R&D. The BERD survey is an annual survey collecting data on R&D activities from 4,000 firms in Great Britain. Businesses are surveyed from a sampling frame of known R&D performers, collated from the ABS and a range of other sources.

The top 400 firms by R&D expenditure are surveyed every year and receive the long form of the survey, while the remaining 3,600 businesses are selected by stratified random sampling by industry-product group and employment size and receive the short-form version of the survey.

Responses for long-form non-responders are imputed from their previous returns, while responses for short-form non-responders and non-sampled firms are imputed via ratio estimation. For more information, please see our [previous release of Quality and Methodology Information for UK BERD statistics](#).

UK Innovation Survey (UKIS)

We used the UKIS to investigate innovative expenditure in UK firms. UKIS collects information on the innovative activities of UK firms over a three-year period. To analyse the relationship between management practices and innovative expenditure, we use the UKIS measure of internal and external expenditure on various innovative investments (detailed in the Glossary) for the final year of the 2014 to 2016 UKIS, which coincides with the 2016 MES reference year.

UKIS uses the Inter-Departmental Business Register (IDBR) to create a stratified sample of firms with employment of 10 or more. Roughly ten per cent of the target population is sampled in UKIS. Weights on respondents are adjusted to ensure representativeness of the total business population using the IDBR. On average, each respondent is weighted to represent 15 enterprises in the business population. For more information, please see the UK Innovation Survey [report](#).

Annual Business Survey (ABS)

The ABS is an annual survey for businesses in the production, construction, distribution and services industries. ABS uses the IDBR as a sampling frame, from which around 62,000 Great British firms are surveyed each year.

The ABS gives information on the approximate gross value added (aGVA) for each reporting unit surveyed in the UK economy. aGVA is calculated by taking the income of a surveyed firm and subtracting their intermediate consumption. When divided by a firm's employment, this figure gives the labour productivity measure we use. For more information, please consult our [previous release](#).

Caveats

Several caveats apply when interpreting these results. First, given the sample sizes of the MES, BERD and UKIS and the nature of random sampling, the linked samples used in this analysis are by necessity small, and potentially selected. Table 1 shows that the linked samples are not too different on observable firm characteristics than non-linked firms in BERD and UKIS, especially on R&D spend. Still, differences might exist on relevant non-observable dimensions.

Table 1: Firms linked to MES are broadly comparable to non-linked firms in BERD and UKIS
Descriptive statistics for linked samples, between MES, BERD and UKIS, MES-BERD and MES-UKIS, 2016

	R&D active in MES sample	R&D active not in MES sample	BERD respondents in MES sample	BERD respondents not in MES sample	UKIS respondents in MES sample	UKIS respondents not in MES sample
Mean employment	203	107	744	917	473	263
Mean turnover	52,990	28,541	244,733	261,608	81,031	68,243
Mean R&D spend	-	-	14,816	14,050	-	-
Number of observations	2,453	36,763	312	1,644	1,644	11,283

Source: Office for National Statistics – Management and Expectations Survey, Business Enterprise Research and Development Survey and UK Innovation Survey

Notes:

1. For information on the data coverage of our matched Management and Expectations Survey (MES) and Business Enterprise Research and Development Survey (BERD) sample, see our Data sources and quality section.
2. For information on the data coverage of our matched Management and Expectations Survey (MES) and UK Innovation Survey (UKIS) sample, see our Data sources and quality section.
3. For further information of "R&D active" status please see the glossary.
4. BERD Respondents refers to firms who responded to the BERD survey in 2016.
5. UKIS respondents refers to firms who responded to UKIS 2017 covering 2014-2016.
6. Employment and turnover means for all subsamples comes from matched IDBR employment and turnover data.

We also use data related to firm activity in 2016 because this is the latest year for which MES, BERD and UKIS data are currently available. MES and BERD can be linked for 2019 and the data to do so is available via the [Secure Research Service](#). However, since the 2019 data for both surveys was collected during the 2020 coronavirus (COVID-19) pandemic, response rates are much lower than usual and should be treated with the necessary caution.

Third, several of the variables used in the analysis are noisy and hard to capture (for example, the share of turnover attributable to innovative activity). These results therefore need to be interpreted with particular caution.

Finally, we want to stress that the relationships uncovered in this analysis are merely correlations and not necessarily causal relationships. Good management practices in this sample are associated with better R&D and innovation outcomes, but better management and higher innovation could both be outcomes of a third, unobserved, variable such as the knowledge embedded in a firm's employees. Foreign ownership and exposure to foreign trade for instance have also been shown to be positively correlated with R&D activity, management practices, and productivity.

11 . Future developments

We plan to continue publishing firm-level analysis on the link between management practices and important economic variables, such as innovation and productivity. We currently have work under way that considers management as a type of intangible capital, and on firm lifecycles. As newer microdata becomes available, we also aim to update and extend this analysis. We welcome feedback on this and all of our work, at mes@ons.gov.uk. You can also connect with statistics producers and users on [Statistics User Net](#).

12 . Authors

Jakob Schneebacher, Kyle Jones, Josh Martin, Georgia Wyse.

13 . Related links

[Management practices in Great Britain: 2016 to 2020](#)

Article | Released 17 May 2021

Initial results from the Management and Expectations Survey, covering data from 2016 to 2020. Part of the Economic Review: May 2021.

[Management practices, homeworking and productivity during the coronavirus \(COVID-19\) pandemic](#)

Article | Released 17 May 2021

Investigating the role of good management before and during the pandemic, with a special focus on the adoption of homeworking and online sales. Part of the Economic Review: May 2021.

[Management practices and productivity in British production and services industries - initial results from the Management and Expectations Survey: 2016](#)

Article | Released 6 April 2018

Results from the second wave of a pilot survey, the Management and Expectations Survey, which gathered information on British management practices and firms' expectations for future growth.

[UK Innovation Survey 2019: Main Report](#)

Report | Released 30 July 2020

This report presents the detailed findings of the 2019 UK innovation survey (UKIS 2019) covering the period 2016 to 2018.