A Systematic Review of the Relationship Between Skills and Productivity

Prepared for Government Skills

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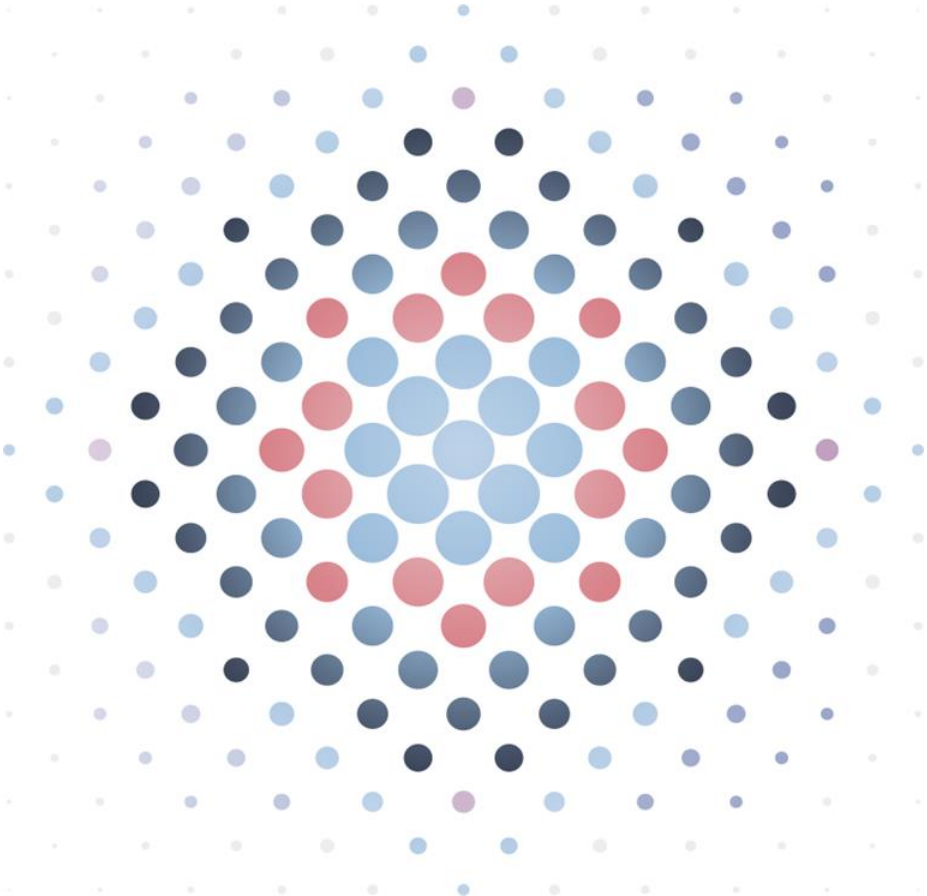

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Executive Summary

Introduction

The UK's public sector employs almost six million workers, including more than half a million in the civil service (Office for National Statistics 2024). The productivity of this sector is therefore of great importance for the UK. A number of studies within and outside the government have identified the skills of the workforce as an important driver of productivity (Becker 1994; Conlon et al. 2023; Gambin, Green, and Hogarth 2009; OECD 2016), and the UK public sector has invested significant resources in developing skills (DFE 2024; NHS England 2024; Government People Group 2024).

For the civil service to make effective decisions about how and how much to develop the skills of its workforce, it needs to understand the overall strength of evidence for a relationship between skills and productivity, and the contexts and conditions under which any such link is strongest.

However, the empirical evidence on the relationship between skills and productivity is diverse, and within the public sector, evidence is relatively sparse. This makes it difficult to identify what is known and can reliably guide policy and practice and, conversely, which policy-relevant questions remain unanswered and should be prioritised in future research and evaluation.

Against this background, Government Skills commissioned a systematic review to understand the extent to which workforce skills can be a driver of public sector productivity, and the systemic conditions that this relationship depends on. This forms part of a wider programme of work that attempts to build a robust evidence base to inform policy efforts to deliver a skilled civil service.

Objectives

This review aimed to synthesise existing literature to develop a clearer understanding of the relationship between skills and productivity in the public sector, and what this relationship depends on. It also seeks to build a clearer picture of what is not understood about this relationship.

In order to achieve this, the following research questions were addressed:

1) **Is there a relationship between the skills of government and public sector workers and public sector productivity, and what is the nature and magnitude of this relationship?**
2) **Which systemic conditions and contexts influence the nature of the relationship between public sector skills and productivity?**
    a. Which types of skills levers can bring about systemic change towards higher productivity, and through which mechanisms do they have their effect?

What did we find?

1) **Research Question 1: Is there a relationship between the skills of government and public sector workers and public sector productivity, and what is the nature and magnitude of this relationship?**

We found a total of 31 papers that provided estimates of the skills-productivity relationship. Findings from these papers can be summarised as follows:

Strong evidence of a positive association between skills and productivity, but causality is a bigger question mark.

Despite there being a limited volume of evidence, the weight of evidence is strongly in favour of there being a positive association between skills and productivity. The 31 papers identified included 38 statistically independent estimates of the relationship between skills and productivity. 33 of those 38 found a positive association, 17 of which were statistically significant (meaning they are very unlikely to have occurred by chance in the absence of a real link between skills and productivity).

It is difficult to be sure whether the relationships identified are purely "causal" in nature—that is, that an increase in skills is the cause of an increase in productivity, rather than some other factors that might be associated with skills. Different studies use different approaches to try to isolate the causal impact. The broad findings are similar across a range of methods. For example, methods that use data across multiple time periods, which are able to control for even unobserved drivers of productivity if they do not change over time, return positive estimates in six out of eight cases.

The skills-productivity relationship may take time to fully materialise.

Two studies found that the positive association between skills and productivity is stronger in the long run than in the short term, suggesting that improvements in skills may take time to fully translate into productivity gains. This is also indirect evidence of context-dependence of the skills-productivity relationship—something which other papers find more directly, as discussed below.

The relationship may be stronger in high-skilled sectors.

Two studies (by the same author and with an overlapping sample of data) found that the relationship between skills and productivity tends to be stronger in higher-skilled sectors. Examples of these sectors include public administration and health and social work. One reason why this is significant in the context of this review is that, on average, the public sector is relatively highly skilled.

2) **Research Question 2: Which systemic conditions and contexts influence the nature of the relationship between public sector skills and productivity?**
    a. **Research Question 2a: Which types of skills levers can bring about systemic change towards higher productivity, and through which mechanisms do they have their effect?**

Most of the papers we identify provide limited evidence on how the skills-productivity relationship is influenced by other factors. Enhancing the evidence base on these, and other potential contexts and conditions, would be a particularly valuable avenue for further research to take. However, our review did identify several studies that, taken together, suggest that the skills-productivity relationship is context-dependent—even though no single contextual factor is studied in more than three papers, making it difficult to draw strong conclusions about precisely which contexts matter.

There is a small amount of evidence that the skills-productivity association may tend to be stronger in larger firms, higher-skilled sectors, and among older workers, although without more literature on these topics these conclusions are highly preliminary. Interestingly, most of the compelling evidence of context-dependence of the skills-productivity relationship is in relation to things that are potentially within the power of workplaces to influence, and which could therefore be considered “levers” that can boost the productivity-enhancing impact of upskilling. These can be summarised as follows:

Skill mismatch and utilisation

Three papers highlight that the degree of alignment between the skills workers have and the skills required by their jobs is an important determinant of productivity. The idea that skills translate into productivity more when jobs fully utilise those skills aligns with wider literature in the UK (e.g., Stansbury, Turner, and Balls 2023). This point may also be related to the evidence discussed above that the skills-productivity relationship is greater in high-skilled sectors, if these sectors are better able to make use of increased skill.

Contractual arrangements

A single paper within our review found that the contractual arrangements between workers and firms can significantly influence the skills-productivity relationship. In particular, the relationship between skills and productivity was found to be stronger in firms that use fixed-term contracts temporarily (before converting them to permanent contracts) than in firms that use fixed-term contracts for longer periods. The authors argue that the use of fixed-term contracts for a short period likely reflects their use as a “screening device” to identify workers who are a good match for the firm before

taking them on permanently. It is therefore possible that this finding is also related to there being a stronger skills-productivity relationship when workers are well-matched to their jobs.

Innovation

Two studies found evidence that workplaces with more innovation exhibit stronger skills-productivity relationships. In one of these studies, the positive relationship between human capital and productivity was seen only within the most innovative 25% of firms.

Management practices

One paper in our review finds evidence that the human capital of a firm and management practices are complementary, and the skills-productivity relationship is stronger in the context of better management practices.

What are the implications for policy?

On the basis of the evidence identified, our review presents three main takeaways for policy.

Successful attempts to improve skills are likely to bring productivity benefits to the public sector, though the size of the benefit is uncertain.

On the basis of the evidence we have, successful attempts to improve skills are likely to bring productivity benefits to the public sector. The empirical tendency for skills and productivity to be positively associated is clear. The ability of the empirical evidence to demonstrate causality is less clear in any individual study. One of the benefits of synthesis, however, is that we can see a consistent tendency towards finding a positive association across the main methodologies employed in the literature.

Besides the crucial question mark over causation, the other caveat around this first policy implication concerns the magnitude of the effect. While there is good reason to expect successful skills investment to raise productivity, it is less clear how powerful it would be. This is because the literature is so diverse that it was not possible to meaningfully combine the different estimates of the skills-productivity relationship to summarise their magnitude (which we would otherwise have done, through meta-analysis).

Skills policy should be designed carefully alongside other, complementary policies.

Several pieces of evidence point to the fact that the relationship is context-dependent.

Importantly, several of those contexts—in particular, skills utilisation, innovation, and management practices—can, in principle, be influenced by policy. Policy-makers should take away an emphasis on effectively integrating skills policy with wider policies, like those relating to workforce and management, to get the most out of skills improvements.

There is a case for supporting more evaluations to improve the evidence base.

The limited literature on the relationship between skills and productivity and the contextual factors that can influence it should be expanded through more rigorous evaluation of interventions to improve workforce skills.

Implications for further research

The evidence base on the factors that can influence the skills-productivity relationship is thin. It is also naturally limited by the available data, which tends to make certain contextual factors much more readily studied than others. Future research on the relationship between skills and productivity would benefit from more detailed information about what actually happens within workplaces—how workers interact, what they are and are not empowered to do, how they are treated, etc.—rather than the sort of firm accounting or labour force characteristics data more commonly already available. This will enable empirical research to study the potential role of a greater number of factors, well-grounded in theory.

A more precise understanding of the role of contextual factors would also make it easier to translate evidence derived from other contexts (such as the private sector) to parts of the public sector. This is a key challenge because the vast majority of the literature we identified was not studying the public sector specifically. A key barrier to such empirical studies is that productivity is harder to measure reliably within the public sector. Developing more robust techniques for measuring productivity directly within the public sector would also enable a significantly stronger evidence base to be built.

How did we generate these results?

We conducted a systematic review of evidence on the relationship between skills and productivity. A systematic review is a careful and organised way of finding, evaluating, and summarising available evidence. It is ideally suited to provide an unbiased and reliable assessment of existing evidence, using transparent, clearly defined, and replicable procedures. By synthesising insights from a fully comprehensive set of literature that satisfies specified criteria, it also delivers a clear view of where there are gaps in the evidence base, helping to provide foundations for future research.

What did we search for? We searched for English-language quantitative studies from OECD countries, published from 2014 onwards. These studies had to examine both skills and productivity, with at least one of these constructs measured at the macro (region, sector, wider economy) or meso (team, organisation, department, firm) levels. Studies from the civil, public, and private sector workforce were within scope.

Where did we search? We searched a range of academic bibliographic databases (e.g., Web of Science, Scopus, IDEAS/RePEc) and grey literature repositories (e.g., GOV.UK) and also conducted a call for evidence. In addition, we examined the citations of the studies included through the searches.

Following our search, how did we confirm which studies to include in our analysis? After conducting our initial search, we finalised the selection of studies

through a systematic screening process. All retrieved records were first imported into Zotero reference management software, where duplicates were identified and removed. We then screened the titles and abstracts, supported by the online tool Rayyan, applying our predefined eligibility criteria to determine which studies warranted full-text review. During the full-text screening stage, we included only those studies that met all specified criteria, including relevance to geographical focus, target population, intervention type, outcomes measured, and research methodology.

How did we extract information from the included studies? After finalising the selection of included studies, we systematically extracted key information from each one, including bibliographic details, geographical focus, research design, population characteristics, type of intervention, outcomes measured, and the quantitative data required for synthesis. To ensure clarity and consistency, reviewers first discussed each data element and piloted the extraction process to determine whether additional guidance was needed. A 10% sample of the studies underwent independent double extraction to check for reliability, with any discrepancies resolved through team discussions. Once consensus was reached, the remaining data were extracted. This process ensured that all relevant study characteristics and outcome data were accurately captured for analysis.

How did we synthesise this information to answer the research questions? We first analysed the risk of bias within the included studies using the Mixed Methods Appraisal Tool (MMAT). This evaluation helped us understand the reliability of the study findings by identifying potential limitations in the study design or execution that could affect the accuracy of the reported results. Two studies were excluded from our subsequent synthesis based on this assessment.

We then used a combination of quantitative synthesis, through vote counting, and narrative synthesis. Vote counting is a statistical procedure that we used to assess the overall strength of evidence for whether there is an association between skills and productivity. Narrative synthesis summarises the combined findings of a set of literature as it pertains to a research question without the use of statistical techniques. **Further details on how we synthesised the results from the included studies to address each research question are provided below.**

Research question 1: Despite an intention to conduct a meta-analysis at the outset, this proved infeasible due to the wide diversity of studies, particularly with respect to their methodologies. This meant that studies were not estimating the same thing, and hence that comparisons between the magnitudes of the effects they estimated would not be meaningful. As an alternative, we conducted a **narrative synthesis** of the papers and also implemented a statistical **vote-counting** exercise to rigorously understand the weight of evidence on the direction of the skills-productivity association. The narrative synthesis was used to descriptively summarise and interpret the findings across studies, identifying common patterns and linking related insights. The statistical vote counting involved counting the number of “independent” results (results that do not use overlapping samples of participants), reporting positive or negative effects, without assessing the size or strength of those effects.

Research question 2 and 2a: These questions were analysed wholly through the narrative synthesis of results. This synthesis allowed us to identify common themes across papers on the key contexts and conditions that could potentially influence the skill-productivity relationship.

What are the limitations of this research?

Our review identified important limitations within the evidence. Most importantly, the **causality of the skills-productivity** relationship is hard to establish empirically with high confidence. Papers in our review commonly studied large units of analysis, such as regions or sectors. Randomised experiments are not conducted at this scale. It is therefore unsurprising that none of the papers we reviewed used experimental methods, and only one used a quasi-experimental approach. As a consequence, it is uncertain to what extent the estimates we reviewed represent only a causal impact of skills on productivity.

Another challenge encountered within our review was the **limited number of papers that fulfilled the eligibility criteria**. Although there is a large amount of research focused on either skills or productivity, much of this research does not directly examine the link between the two, or does not do so within a context (e.g. an OECD country) that we considered relevant enough for inclusion. The small number of papers was a particular limitation when it came to formal statistical synthesis.

In addition, the studies were widely varying. They varied in their definitions of skills and productivity, in the measures used to assess each of these (e.g. skills could be measured through tests, or through the number of years of education), and units of analysis (e.g. studies could look at the region, firm or team levels). They also varied widely in the methodological approach that was used to study the link between skills and productivity. This lack of comparability across studies was a barrier to performing meaningful synthesis of the magnitudes of the effects that they estimated.

Our review also found a **very sparse evidence base on factors that the skills-productivity relationship depends on**. This limited the strength of the conclusions we were able to draw in relation to Research Question 2. While several studies found evidence of context-dependence, no single contextual factor was the subject of more than three studies.

There were some limitations in the review process as well, such as:

- Possible exclusion of papers that focus on specific types of skills. The terminology used to describe skills and productivity in the literature is varied. We therefore made a careful attempt to create an exhaustive list of search terms, but it is possible that some relevant terms were not included.
- A reliance on titles and abstracts of papers for the screening process can limit the included evidence, as abstracts in economics and related subjects are often unstructured and lack the keywords that can communicate the contents of the paper clearly.

- Our geographical inclusion criteria limited the review to OECD countries due to their more comparable economic and administrative structures. However, a majority of the public sector literature on skills pertains to lower-income, non-OECD countries, and this may contain some relevant insights.

Lastly, we recognise limitations within our synthesis of results. Our application of statistical vote counting and narrative synthesis provided useful insights and helped address the heterogeneity within the evidence base. However, they do not allow us to identify the magnitudes of effects or to compare these between groups of studies, as would have been possible if the literature had allowed for meta-analysis. This naturally limits the richness of what can be inferred from our review.

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