

High-performance work systems and the performance of public sector workplaces in Britain

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Abstract

We assess the role played by high-performance work systems (HPWSs) in public sector management achieving cost reductions and efficiency savings, and in introducing ‘modernizing’ technical and operational changes. Using a nationally representative survey of public sector workplaces with 50 or more employees we find that increased use of HPWS was positively correlated with workplace financial performance ratings and the implementation of workplace organizational change, and negatively correlated with wage costs. We also find target setting (TS) practices are, as much as HPWS, significantly associated with workplace outcomes. First difference estimates for the financial rating and workplace change outcomes qualitatively support the cross-section findings in these respects. We conclude that both HPWS and TS are important management technologies for managers pursuing government objectives in the public sector.

JEL classifications: J45, M5

1. Introduction

There is a large body of research on the effects of human resource management (HRM) practices on organizational, workplace, and employee outcomes, but most of this concerns the private sector. Of the few studies that have looked at the public sector, most have been confined to a particular branch such as local government, schools, or hospitals.

We contribute to the development of HRM research in the public sector by studying medium-sized and larger workplaces across the whole of the British public sector. The study covers those aspects of HRM that in the previous literature have been taken to represent ‘high-performance work systems’ (HPWSs) (Appelbaum *et al.*, 2000). HPWS incorporate several complementary sets, or domains, of HRM practice. We assess effects both in terms of an index of HPWS intensity and in terms of component domains.

Our primary aim is empirical: the question we ask is whether positive effects on performance, as reported in many private sector studies, also hold for the public sector. In order to set up our study, we have had to consider the nature of performance goals in the public sector and the ways in which HPWS may be expected to assist in the pursuit of those goals.

The public sector has performance goals imposed by central government. It is the existence of these central goals that renders a sector-wide study feasible. Revealed government priorities for the sector over much of the last two decades, and particularly in the post-recession 'austerity' period, have been to restrain costs, and to stimulate change toward 'modern management', meaning to a large extent the adoption of private sector methods. We assume that governments are able to obtain the assent of public sector managements to the central goals because they set budgets, control resource flows, and can impose legally binding duties on management. Indeed, government can fire non-compliant senior executives and on occasion does so (Hood, 2006).

Of course, each branch of the public sector also has its own service mission and its own performance aims with respect to that mission. These lie outside the scope of the present research and will be better investigated in separate branch-level studies.

To represent how HPWS serve performance aims, we adopt the 'management technology' concept of Bloom *et al.* (2017) (henceforth, BSV). (See also Bloom and Van Reenen (2011) for review of econometric studies of HRM-performance relationships). Situating HRM practices within management technology implies that they operate alongside other instruments such as target setting (TS), performance monitoring, and correction of sub-standard performance. HPWSs appear to fit within this perspective since they consist of complementary sets of methods and processes that can be deployed by management to meet managerial objectives such as aligning employees with performance aims, obtaining fresh ideas from employees toward those aims, and coordinating their efforts. Much of the early literature on the performance effects of HPWS focused on the 'fit' between management practices and the environment faced by an employer, thus placing a great deal of emphasis on the applicability of 'bundles' of practices, or domains, in different settings. Although we investigate the role of various practice domains, we follow the recent literature which emphasizes the potential for intensive HPWS usage to meet managerial requirements, irrespective of the circumstances faced by the organization.

In the next section, we assess the public sector background in Britain. This shapes our ideas about the functions of HPWS within the sector, which is the focus of Section 3: we argue that HPWS can help public sector management tackle the twin challenges of labour cost reductions and organizational change. Section 4 describes research data and methods, Section 5 the results, and Section 6 concludes and briefly comments on research implications.

The main new findings of this research are, first, that the public sector workplace median wage is reduced, and workplace change activity is increased, with an increasing intensity of HPWSs; and secondly that TS practices are also a significant correlate of workplace outcomes, especially those that relate to workplace change.

2. The public sector background and new public management

Three main dimensions of traditional personnel management in the public sector have been discerned in the reviews of Farnham and Horton (1996) and Bach *et al.* (2009): (1)

'Paternalism', meaning an emphasis on welfare provision, notably pensions; (2) 'collectivism', referring to a near-universal union presence; and (3) a 'model employer' orientation, in the sense of commitment to procedural justice and fairness of treatment (e.g., equal opportunities practice).

These characteristics of the public sector personnel tradition have increasingly come to be seen as unhelpful for efficiency. Because of this tradition 'efficient working practices and attempts to reduce costs are unlikely to be of much concern to public sector managers' (Gould-Williams, 2004, p. 66). Government has attempted to promote a degree of decentralization and flexibility, and the development of workplace HRM functions can be seen as part of this shift. Bach *et al.* (2009, p. 325) speak of 'much greater focus on raising the efficiency of the public sector and its workforce, which we term a performance orientation'. They point to the widespread adoption of individual performance appraisal, continuing in-work training, involvement of staff (through for instance provision of information about finances and staffing), and flexible labour practices such as the use of agency staff and outsourcing of ancillary activities.

During the 1990s the funding of public services in western economies reached a critical juncture, with cost pressures on national budgets coming largely from demographic developments, notably increasing longevity (Esping-Andersen, 1996). British governments have had two main ideas for responding to these pressures: tighter financing and institutional reform. Most obviously, the budgets of many public services have been cut, and there have been continual demands for 'efficiency savings'. During the 1990s, the British public sector experienced a net loss of 800,000 jobs (Hicks *et al.*, 2005). After a few years of recovery during the early 2000s, the economic recession of 2008 was followed by an 'austerity' regime that involved further staff cuts: recent estimates (ONS, 2019) show a cumulative reduction from 2008 of about 600,000 jobs took place. Despite these efforts, official statistics show the British public sector in 2014 behind France, Germany, and the European Union average, in terms of a conventional measure of productivity (ONS, 2017).

Alongside financial restrictions on public services, government has sought qualitative change in service management. The 1990s were marked by change in the private sector's labour systems, with adoption of information and communications technology (ICT), call-centres, outsourcing, new hours schedules and work contracts, among the more salient responses to intensifying competition (Grimshaw *et al.*, 2001; Green, 2006). What is seen as 'modern management' in the private sector has commonly been held up as the exemplar for public sector organizations to follow. For example, the Local Government Act 1999 imposed a 'Duty of Best Value' on local government bodies whereby they were obliged to seek continuous improvement with regard to 'economy, efficiency, and effectiveness'. Central government bodies have also subsequently committed to this regime. Another development, common to a number of countries, has been the advance of 'marketization' of the public sector through, for instance, competitive tendering and privatization (LeGrand and Bartlett, 1993). This suite of developments has been labeled the new public management (NPM) (see Burke *et al.*, 2013 for an international perspective). In Britain, workforce restructuring has become widespread, for instance through the use of 'teaching assistants' alongside teachers (Blatchford *et al.*, 2012), or additional use of agency nurses to achieve flexible staffing in the NHS (McIlroy *et al.*, 2016); the subcontracting of ancillary work to the private sector has become virtually universal across the sector (Bach *et al.*, 2009, p. 314–5).

In summary, salient tasks for public sector management have been to support and contribute to financial savings, and to maintain progress in implementing operational change. The question for our research is whether and how HPWS has contributed to this agenda.

3. HPWS as a management technology for the public sector

We conceptualize HPWS as a ‘management technology’ (BSV) that facilitates delivery of performance gains. Viewed from this perspective, the development of HPWS is a managerial choice adopted to serve the objectives of management, whatever they might be. This instrumental view of HPWS differs from much of the HRM literature, issuing from business studies or work psychology specialisms, that has attributed a type of employee motivational agenda to these practices. This has been given a positive sense in most of that literature (e.g., Kochan and Osterman, 1994; Appelbaum *et al.*, 2000; Jiang *et al.*, 2012; Peccei *et al.*, 2013), but there is also a critical strand that interprets HPWS as a managerial ‘low road’ strategy extracting stressful levels of effort from employees (e.g., Ramsay *et al.*, 2000; Ashkenasy *et al.*, 2016) and reducing labour costs. The management technology concept neither relies on nor excludes such intervening processes. However, part of the concept’s attraction lies in its simple and direct assertion of the function of HRM practices in facilitating management agency. For instance, if management is seeking workforce economies, it is advantageous to have employee support, aided by systems for reconfiguring staffing structures. HPWSs constitute relevant practices.

The complementary sets, or ‘domains’ of HPWS practice used in our research are found in numerous previous studies, and most clearly in Appelbaum *et al.* (2000). The domains consist of recruitment and selection, training and development, performance-related pay, team working organization, and ‘participation’, which includes several types of communication and consultation. (Any set of domain labels is somewhat arbitrary. For instance, team working might be considered part of ‘participation’ but could also be included as part of a broader ‘communication’ concept. Also new domains can be formed by adding practices. The additive ‘intensiveness’ concept spans such possibilities). The intensiveness with which a domain, or HPWS as a whole, is practiced in a workplace is represented by the number of implemented practices (Becker and Huselid, 2006). The more recent literature on ‘management as technology’ exemplified by BSV also captures the intensity with which HPWS are implemented with an additive scale which simply sums the number of practices present in the workplace. Although there is a recognition of the complementarity across practices—for example, monitoring is used as a method for ensuring targets are pursued, while records are kept to establish progress towards meeting those targets—the empirical evidence suggests that associations between HPWS intensity and productivity and performance are linear. This seems to be the case in most settings, both in the private sector and sectors dominated by public sector provision (e.g. hospitals (Bloom *et al.*, 2017) and schools (Bloom *et al.*, 2015)). The implication is that no one set of practices is likely to suffice in improving organizational performance, and that strong complementarities between specific bundles of practices—which would generate interactions reflecting super-modularity (Milgrom and Roberts, 1995)—are not common.

The consistency of results across sectors implies that what Becker and Huselid (1998) refer to as the ‘internal fit’ between high-performance practices and other policies and procedures that employers deploy may not be a critical determinant of the value of HPWS. Instead, results support BSV’s contention that the returns to intensive HPWS are fairly

universal. The combined effect of complementary HPWS domains was previously emphasized in [Bowen and Ostroff's \(2004\)](#) work in which they put forward a 'strong system' theory that emphasized the value of implementing numerous mutually reinforcing practices in 'signalling' management intentions to employees. [Combs *et al.* \(2006\)](#) concluded from their meta-analysis of the HRM-performance relationship that summative measures of practice have been about twice as predictive of outcomes as use of separate practice variables.

Perhaps the biggest issue facing managers in the public as opposed to the private sector is that their ultimate goal is the provision of public goods subject to a budget constraint imposed by government, as opposed to profit maximization. In the context of NPM and the policy agenda discussed in Section 2 this translates into a programme of organizational change with a view to cost minimization through the reorganization of labour since labour costs constitute a very high proportion of total costs in the public sector. Although rarely emphasized in the HPWS literature in the private sector, HPWSs offer opportunities to minimize costs through alterations to the organizational hierarchy—for example, through removal of middle-management previously required for monitoring purposes and the broad adoption of Taylorist principles of work organization which institute working arrangements delivering efficient production.

Adopting a labour process orientation to HPWS, [Ramsay *et al.* \(2000, p. 503\)](#) argue it has the potential to reduce labour costs 'through a reduction in the need for control and monitoring'. Using an earlier version of the data we analyse (WERS 1998) they test the hypothesis that 'HPWS practices are expected to lead to a reduction in labour costs, reflecting the "low-road" emphasis in LP [labour process] interpretations' (2000, p. 511) of their function. They conclude that 'in support of LP predictions...the [HPWS] score was positively related to reductions in labour costs' (p. 519, [Table 5](#)). There is a whole economy analysis, but it illustrates the potential value HPWS management technologies have in reducing labour costs for public sector organizations.¹

Managers' ability to engender the sorts of organizational changes envisaged in the NPM literature means the communications, consultation, and participation domain (which we will refer to simply as participation) is of primary importance for achievement of both financial and change goals in the public sector. [Milgrom and Roberts \(1992, p. 271–80\)](#) observe that any process of organizational change entails 'influence costs' that arise from effort diverted into bargaining over distributional implications. An effective system of discussion and consultation can reduce these costs and thus increase the feasibility of change projects. [Fernandez and Rainey \(2006\)](#), proposing a schema of effective change in the public sector, emphasize the importance of building employee support and overcoming resistance. [Overmans \(forthcoming\)](#) comments that participation methods provide the most usual path to overcoming resistance, although managerial fiat may be preferred in crisis conditions. [Neathey and Arrowsmith \(2001\)](#) provide a case study showing how consultation and participative problem-solving were developed in a hospital in order to implement changes in working time. [Bryson *et al.* \(2017b\)](#) using a differencing method have found participatory practices to be predictive of a measure of overall school performance as judged by managers.

Following [Appelbaum *et al.* \(2000\)](#), we assume that other HPWS domains play a supporting role in pursuit of cost reductions, illustrating the complementarity of HPWS domains. Team-working organization potentially contributes by providing a structure for

1 Their labour costs measure is not based on accounting information but is of a subjective type, as is the case with the overall financial performance measure we and other have used.

translating and implementing agreed policy at the front line. Teams can also internalize (part of) training and monitoring costs. If cost reduction plans involve changes in staffing numbers, structures, and roles, there may well be implications for recruitment and selection; [Besley and Ghatak \(2005\)](#), in a theoretical analysis of principal–agent relations in mission-serving organizations, have emphasized the role of recruitment (e.g., of people with new skills and/or change-positive orientations) in achieving change desired by principals. Training and development practices can also be used to adapt the workforce to change of various types. [Gould-Williams and Gatenby \(2010\)](#) in their study of local government found that both team-working and receipt of training were associated with an aggregated measure of perceived workforce effectiveness based on staff perceptions concerning quality of service, reputation, value for money, and avoidance of waste.

Finally, one might assume that incentivizing and motivational practices play a part in pursuit of performance and change. Indeed, one of the main strands in the management literature has been in delineating motivational pathways that are activated by reward practices and other HPWS practices in combination ([Jiang et al., 2012](#)). However, doubts have been expressed about whether this is applicable to the public sector, where a distinctive ‘public service motivation’ ([Perry, 2000](#)), of a non-pecuniary character, has been thought to prevail. [Burgess and Ratto \(2003\)](#) indicated why incentive pay might not work in the public sector, including problems of measuring and attributing output, and the prevalence of multi-tasking (see also [Burgess and Metcalfe, 2000](#)). Consistent with such predictions, [Bryson et al. \(2017a\)](#) found incentive pay negatively correlated with workplace performance in the public sector. However, a review by [Prentice et al. \(2007\)](#) reports some evidence of performance pay providing benefits in the public sector, though limited by design problems. [Burgess et al. \(2010\)](#) have shown that the introduction of team-based performance pay affected task allocation by managers and improved team performance. Overall, there remains much uncertainty with regard to incentive pay in the public sector.

How can the potential of HPWS be applied to achieve financial savings in the public sector? Labour costs are crucial, in view of the high labour intensity of public services, but there is little scope for local managements to achieve economy through pay fixing, because of centralized pay bargaining. Moreover, UK public sector savings have often been imposed from above through site closures or through budgetary cuts that restrict recruitment. There remain however two ways in which workplaces can contribute to labour cost reduction: first, through (partial) substitution of high-cost staff by less-costly staff, and second, by exploiting monopsony power ([Manning, 2005](#); [Ashenfelter et al., 2010](#)) in recruitment and retention practice. Both processes are attested for parts of the sector. In schools, ‘teaching assistants’ have been placed in many classrooms with saving implications for teacher numbers ([Hancock and Eyres, 2004](#); [Blatchford et al., 2012](#)). Use of monopsony power to trim entrant salaries has also been analysed in schools in the USA ([Ransom and Sims, 2010](#)) though not yet in Britain. Monopsony power is also likely to be important in healthcare, including through overseas recruitment, that provides about one in seven of NHS staff ([House of Commons Library, 2019](#)). The predominance of female employment in the public sector connects with monopsony explanations of gendered pay discrimination suggested by [Robinson \(1969\[1933\]\)](#).

In the light of the foregoing observations, we predict an overall negative relationship between HPWS intensity and wage costs in the public sector.² Participation practices are

2 For the mixed evidence relating to HPWS and wages or labour costs in the USA’s private sector, see the review in [Osterman \(2006\)](#).

predicted to be important here, because of the distributional implications of modified staffing structures; recruitment and training are also likely to play a part in adjusting the workforce. No prediction is made concerning the role of incentive pay, in view of the conflicting evidence from existing studies.

Turning to adoption of 'modernizing' operational change, the complementarity of HPWS domains is particularly evident. Participation processes help to reduce influence costs in gaining acceptance of change preliminary to implementation. However, a positive outcome from consultations may depend on staff confidence in the team-working, recruitment, and training practices that are needed in setting up and running a new system or service. The implied prediction is of positive relations between change outcomes and the intensity of each of these domains as well as with overall HPWS intensity.

As indicated in BSV's management technology concept, HPWS themselves complement other management techniques; among these is TS. In the present research, we explore the role of TS when it is represented alongside HPWS. Following BSV we predict that TS will have positive independent effects, but our interest is mainly in the sensitivity of the HPWS effect to the inclusion of TS.

4. Research data and methods

4.1 Data and variables

The chief dataset for the research was the Workplace Employment Relations Survey 2011 (see [Van Wanrooy et al., 2013](#)). Information was obtained through face-to-face interviews with senior managers responsible for HRM. Our analysis was confined to public sector workplaces with at least 50 employees. The public sector indicator is based on the HR manager's response to the status of the workplace, and has been found to be a more accurate indicator of public sector status than the reports of employees (see [Blanchflower and Bryson, 2010](#)). The issues in smaller public sector workplaces are different and require separate analysis.³ The overall response rate for the survey was 46 %, yielding 683 cases for our analysis. We also analysed, using panel methods, the subsample of public sector large and medium-sized workplace data that could be linked to the corresponding survey for 2004 ($N = 297$).

4.1.1 Dependent variables Information relating to workplace performance fell into two groups, one relating to financial outcomes and the other to indicators of change activity.

4.1.1.1 Financial outcomes. We used a combination of objective and subjective measures. The objective measure relates to labour costs. WERS11 asked managers to prepare information about the numbers of employees in each of six wage-bands. From this we estimated the median wage by linear interpolation, with logged values as the outcome measure (see [Table 1](#)). The mean of this derived median wage variable was close to estimates for 2011 provided by [Cribb et al. \(2014, p. 6, 42–3\)](#) from official data sources.

Additionally, we made use of management ratings of financial performance, relative to other similar workplaces. The subjectivity of this type of measure renders it less attractive

3 Official statistics for the UK and the EU classify firms with less than 50 employees as 'small'. We have adopted an analogous cut-off for the public sector but have applied it at the workplace rather than the organizational level.

Table 1. Descriptives for dependent variables

	Range	Mean	SD	N
Financial performance				
Median wage (£/hour)	5.48–24.01	13.50	3.74	682
Financial performance rating ^a	1–5	3.62	0.82	617
Workplace change activity:				
New technology/IT	0,1	0.71	0.45	683
New or improved service using technology	0,1	0.47	0.50	683
Working time	0,1	0.36	0.48	683
Work organization	0,1	0.72	0.45	683
Work procedures	0,1	0.66	0.48	683
Index of workplace change	0–5	2.91	1.47	683

Source: Own analysis of WERS2011 public use dataset.

Notes: Statistics are unweighted sample descriptives. For weighted mean estimates of the workplace change activity variables, see [Online Appendix Table A2](#).

^aThe financial rating question asked managers to rate financial performance of their workplace by comparison with other similar workplaces, using five responses ranging from ‘a lot worse’ to ‘a lot better’; ‘better’ responses are scored high.

than the median wage. However, the measure addresses financial performance more broadly than the median wage, and has been used as the chief performance outcome in much previous British research on HRM/HPWS, including from the WERS series (e.g., [Ramsay et al., 2000](#); [Addison and Belfield, 2001](#); [Wu et al., 2015](#)). The WERS question yields a five-point rating scale (see [Table 1](#)). The measure is also available in linked data from 2004. For the WERS04 data, [Forth and McNabb \(2008\)](#) found correlations of 0.4–0.6 between subjective ratings and record-based measures of performance for a private sector subsample where objective data were available. We treated the rating scale as a cardinal measure (see [Ferrer-I-Carbonell and Frijters, 2004](#); [Riedl and Geishecker, 2014](#)). As a robustness check, ordered logit analysis was also performed.

4.1.1.2 Change outcomes. The WERS11 interview presented a list of seven types of change initiative asking whether the workplace had been developing each type during the preceding two years (see [Online Appendix Table A2](#) for details). Outcomes were binary. The same question was also used in 2004.

The main complication in use of this information was the possibility of overlap with HPWS measures. In replying to questions about change initiatives, managers might think of HPWS practices, for instance with respect to performance pay or involvement/participation. To avoid this type of difficulty, we focused our primary analysis on the three types of change that appeared to be most distinct from development of HPWS: (a) change projects concerning development of new technology, including computers; (b) change projects concerning new services that involved new technology or substantial enhancement; and (c) change projects concerning working time arrangements.

As a secondary measure, we summed across five binary outcomes—the three just mentioned, and those relating to work organization and work procedures—to construct an index of change taking values 0–5. To treat this as a linear measure requires a rather strong

Table 2. Explanatory variables: HPWSs

Domains	Contents	Range	Mean	SD
Participation KR20 = 0.69	Meetings are regular; <u>meeting frequency</u> ; <u>staff time in meetings</u> ; <u>briefing frequency</u> ; <u>staff time in briefings</u> ; subjects discussed in meetings (staffing, finance, investment); consultative committee; attitude surveys.	1–11	7.91	1.87
Team working KR20 = 0.57	<u>Proportion in teams</u> ; training for team-working; teams have inter-dependence, responsibility, autonomy; quality circles used.	0–6	3.80	1.24
Training/development KR20 = 0.60	‘Investor in People’ standard achieved; development included in firm strategy; <u>proportion given workplace training</u> ; <u>proportion given off-job training</u> ; <u>proportion given cross-job training</u> ; <u>variety of training courses used</u> ; induction courses used; appraisal for managers; appraisal for all non-managers; employee development is part of workplace strategy; vacancies filled internally if possible.	1–8	5.38	1.41
Recruitment/selection KR20 = 0.62	Selection criteria: qualifications, skills, references, motivation, experience; use personality tests for manager jobs; use personality tests for non-manager jobs; use skill tests for manager jobs; use skill tests for non-manager jobs.	0–8	5.60	1.55
Pay for performance KR20 = 0.81	Bonus for individual, group/team, workplace, organization performance; profit-sharing for non-managers; merit-based or performance pay; appraisals that affect pay differentials; incentives that affect pay differentials.	0–9	1.78	2.05
HPWS index KR20(items) = 0.80	Summative score across the above domains	11–36	24.47	4.45

Source: Own analysis of WERS2011 public use dataset.

Note: All measures are based on $N = 683$ observations. KR20 is the Kuder Richardson reliability measure for dichotomous item scales, computed over the survey sample. Underlined items are quantitative banded variables reduced to dichotomies by splitting at the within-sample median. ‘Investor in People’ is an externally awarded standard for people development.

assumption of equality of changes. We did not use the measure within the cross-section analysis, but brought it in as a ‘back-up’ for the panel-data analysis where it was helpful with sample size issues.

4.1.2 Explanatory variables The chief explanatory variable was a summative index of HPWS practices. In the HRM-performance literature, HPWS items have usually been aggregated into a single overall index of practices, and we followed this method, which is also supported by the [Combs et al. \(2006\)](#) study. All included items were descriptive of

Table 3. Explanatory variables: TS index

Contents	Range	Mean	SD
Index is summed over following set of target dummies: volume of sales/services; total cost; profits/roi; unit labour cost; productivity; quality of product/service; labour turnover; absenteeism; employee training; employee job satisfaction; customer/client satisfaction	0–11	4.93	3.02

Source: Own analysis of WERS2011 public use dataset.

Notes: Unweighted sample descriptives; measure based on $N = 683$ observations. $KR20 = 0.81$.

current practice.⁴ Most items were dichotomous; source items that involved multiple category responses (e.g., proportion of employees covered by a practice) were converted to dichotomies (above the median response versus at or below median); although this sacrifices some information, we considered this was outweighed by likely error-bias reduction. The set (see Table 2) incorporated the majority of items (or close analogues) from previous British studies using data from the WERS series. Drawing on 44 items, our index is more comprehensive than most others in the literature so that associations between it and performance outcomes are less likely to suffer from omitted variables bias. Furthermore, the large number of items used means we are able to populate the sub-domains of high-performance practices which feature in the literature.

In the construction of the HPWS index, items were first grouped into five such domains that were tested and refined by reliability analysis. Items in each domain were then summed to provide a domain-specific index. Domain reliabilities were in the range 0.60–0.81 (similar to US studies of HRM/HPWS), except for the team-working domain where reliability was somewhat low at 0.57. All reliability estimates were obtained by the Kuder–Richardson (KR) method for sets of dichotomous items. The KR reliability of the overall HPWS index was 0.80.

To provide further coverage of management technology, we introduced a measure representing target-setting (TS) intensity. The TS measure was obtained by summing the number of distinct types of targets currently being pursued by workplace management out of a list of 11 types (see Table 3). The sample correlation between this measure and the HPWS index was 0.31 for the whole economy and 0.27 for the public sector; KR reliability was 0.81.

4.1.3 Control variables All explanatory analyses with the cross-section data included control variables of a standard type. Structural variables were workplace size (log of employee number), industry group, age of workplace, and industrial relations structure.⁵

- 4 We exclude opinion data, for instance managers' ratings of the degree of variety, job control, and discretion that employees have in their jobs. Although these may shed light on aspects of job design, responses are captured in a way which may tell us more about the value-judgements of respondents than they do about the incidence or otherwise of particular job features.
- 5 Multi-unionism provides a more sensitive measure than simple union recognition, because unions are recognized throughout most of the public sector. Exploratory analyses using union membership density were also carried out but led to no increase in explanatory power.

Compositional variables covered gender, contract-type, and occupational/skill proportions. For further details and descriptive statistics, see [Online Appendix Table A1](#). For the panel data analysis, the specification of control variables was somewhat simplified; details are given in Section 5.3.

4.2 Analysis methods

Analyses of the (log) median wage measure and the financial performance rating were carried out by robust regression (Berk, 1990), with estimates of standard errors taking account of survey weighting. The specification for the main analyses can be written as follows, ignoring subscripts:

$$Y = X\beta + \text{HPWS}\gamma + \text{TS}\delta + \epsilon, \quad (1)$$

where Y is the outcome, X a vector of control variables including unity, HPWS is the overall index, TS is the TS index, and Greek letters is the parameters to be estimated, with epsilon the disturbance term. A variant specification added an HPWS-squared term to assess functional form.

Additionally, we disaggregated the HPWS index into its domain-specific indices, as follows:

$$Y = X\beta + P\gamma_1 + T\gamma_2 + D\gamma_3 + R\gamma_4 + \text{PP}\gamma_5 + \text{TS}\delta + \int, \quad (2)$$

where P is the participation, T the team-working, D the training/development, R the recruitment/selection, PP the performance pay, and other terms are as in [Equation \(1\)](#).

For the analysis of three change outcomes, we used a trivariate probit specification and the multivariate probit method of [Cappellari and Jenkins \(2003\)](#). The trivariate probit model can be written, by extension of the univariate probit model, as

$$\begin{aligned} y^*_{im} &= B'_m X_{im} + e_{im} \quad (m = 1, 2, 3) \\ y_{im} &= 1[y^*_{im} > 0] \end{aligned} \quad (3)$$

with y^*_{im} the assumed latent variable, e_{im} trivariate standard normal, and error variance matrix having the intercorrelations of residuals as off-diagonal elements. Estimation is via simulated maximum likelihood using the GHK estimator; see [Cappellari and Jenkins \(2003\)](#) for further details. As with the financial outcomes, we estimated both the overall effects of {HPWS, TS} and the alternative specification with the domain indices {P, T, D, R, PP} as separate regressors in place of HPWS. In the former case, covariates were the same for all three outcomes; in the latter specification, however, we omitted the PP domain from the regressors for the 'new technology' and 'new services' outcomes, while for the 'change in working time' outcome we omitted R and retained PP (the latter in view of a literature connecting work-time to incentive pay).

Finally, we utilized cases in WERS11 that could be linked to WERS04 to construct a two-period fixed effect (FE) analysis, applying the linear FE panel model for the financial performance rating outcome, and the conditional logit model for each of the three binary change outcomes. Because of sample-size shrinkage in the conditional logit analyses, we also used a linear FE model of the number (0–5) of change types taking place. In view of relatively small N for these panel analyses, we ran only the specification with the HPWS and TS indices as explanatory variables.

Table 4. Estimated effects of HPWS and TS on log median wage

	(1)		(2)	
	<i>b</i>	s.e.	<i>b</i>	s.e.
HPWS	-0.006	0.0027*		
TS	0.001	0.0048	0.002	0.0046
Participation			-0.016	0.0059**
Teams			-0.009	0.0104
Train/develop			-0.009	0.0096
Recruit/select			0.010	0.0077
Performance pay			-0.005	0.0066
N, R-squared	646	0.572	646	0.582

Source: Own analysis of WERS2011 public use dataset.

Notes: Linear regression analyses with survey weights and robust variance estimator. For definitions of HPWS and TS, see Tables 2 and 3. Analyses include control variables as shown in Online Appendix Table A1. Significance: *5% level, **1% level.

The analyses do not identify a causal effect and use below of conventional terminology, such as ‘effects’ or ‘influences’, should always be regarded as referring to associations. We carried out several checks on robustness of findings: the most important are reported in Section 5.4.

5. Results

5.1 Financial outcomes

Table 4 summarizes results from analysis of the workplace (log) median wage outcome. In specification (1), HPWS intensity had a negative ($b = -0.006$) and significant ($|t| = 2.24$) effect on the median wage while TS’ effect was close to zero. In specification (2), using the HPWS domain indices as separate variables, the effect of the Participation domain was negative and significant ($|t| = 2.72$), while the other domain variables and TS had non-significant effects. To indicate the practical significance of these findings, the estimated marginal mean of the median wage at the lower quartile of HPWS was £12.24 while at the HPWS upper quartile it was £11.79. For a 35-h week and full-time equivalent worker this is around a £16 difference.

Table 5 presents results from analysis of the financial performance rating outcome. In specification (1), both HPWS and TS were positive but only TS was significant; with each one-unit increase in the TS index increasing the rating by about half a unit of the response scale (the inter-quartile range of TS is 4). In specification (2), the estimate for TS remained similar while of the various HPWS domains only Participation was significant ($|t| = 2.52$).

5.2 Workplace change outcomes

Results from the trivariate probit analysis with HPWS and TS indices as explanatory variables are shown in Table 6, and can be summarized as follows: (1) Introduction or extension of new technology, including computers, was positively influenced by both HPWS and TS, both significant at the 10% level; (2) Development of services involving new technology or

Table 5. Estimated effects of HPWS and TS on financial performance ratings

	(1)		(2)	
	<i>b</i>	s.e.	<i>b</i>	s.e.
HPWS	0.013	0.012		
TS	0.054	0.019**	0.050	0.019**
Participation			0.063	0.025*
Teams			-0.023	0.042
Train/develop			0.020	0.043
Recruit/select			0.026	0.032
Performance pay			-0.034	0.022
<i>N</i> , <i>R</i> -squared	587	0.124	587	0.147

Source: Own analysis of WERS2011 public use dataset.

Notes: Linear regression analyses with survey weights and robust variance estimator. For definitions of HPWS and TS, see Tables 2 and 3. All analyses include control variables as shown in Online Appendix Table A1. Significance: *5% level, **1% level.

Table 6. Effect of HPWS and TS indices on three types of change

Change>>	1 New technology		2 New services		3 Working time	
	HPWS	TS	HPWS	TS	HPWS	TS
<i>b</i>	0.040	0.061	0.040	0.118	0.0006	0.102
s.e.	0.021	0.032	0.019	0.030	0.019	0.030
<i>t</i>	1.92 ⁺	1.91 ⁺	2.14*	3.92**	0.03	3.45**

Source: Own analysis of WERS2011 public use dataset.

Notes: Trivariate probit model (simulated maximum likelihood, with 30 replications); specification includes full covariates. $N = 647$, Wald chi-squared(51) = 136.00, $P < 0.001$. Correlation between errors (s.e. in parenthesis): $\rho_{21} = 0.240$ (0.099), $\rho_{31} = 0.228$ (0.104), $\rho_{32} = 0.145$ (0.103). LR chi-squared ($\rho_{21} = \rho_{31} = \rho_{32} = 0$) 2,235.1, $P < 0.001$. Significance: ⁺10% level, *5% level, **1% level.

enhanced provision was positively influenced by both HPWS (5% level) and TS (1% level); and (3) change in working time arrangements was advanced by TS (1% level) but the HPWS point estimate was close to zero. Correlations between residuals are reported in the notes to Table 6: both ρ_{12} and ρ_{13} were positive and significant, while ρ_{23} was positive but non-significant.

We compared the simulated maximum-likelihood estimates with those obtained by maximum likelihood in the three subsidiary bivariate probit models. Estimates were closely similar in all cases. Univariate probit estimates were also closely similar, and from these one can compute practical effect size. For instance, comparing mean marginal effects at lower quartile and upper quartile points, one finds that HPWS intensity shifted the probability of both new technology adoption and of new service introduction upwards by 8% age points. The inter-quartile figures for TS were up 12% age points for new technology adoption, 25% age points for new service introduction, and 22% age points for working time projects.

Table 7. Effect of HPWS-domains and TS index on three types of change

Change>>	New technology		New services		Working time	
	<i>b</i>	s.e.	<i>b</i>	s.e.	<i>b</i>	s.e.
TS	0.069	0.032*	0.115	0.030**	0.108	0.030**
HPWS domains:						
Participation	0.063	0.050	0.044	0.040	0.091	0.048+
Teams	0.122	0.73 ⁺	-0.041	0.070	-0.067	0.067
Train/develop	-0.072	0.061	0.090	0.062	-0.065	0.062
Recruit/select	0.109	0.049*	0.116	0.049*	-	-
Performance pay	-	-	-	-	-0.040	0.041

Source: Own analysis of WERS2011 public use dataset.

Notes: Trivariate probit model (simulated maximum likelihood, with 30 replications); specification includes full covariates. $N = 647$, Wald chi-squared(60) = 162.69, $P < 0.001$. Correlation between errors (s.e. in parenthesis): $\rho_{021} = 0.231$ (0.096), $\rho_{031} = 0.205$ (0.099), $\rho_{032} = 0.146$ (0.097). LR chi-squared ($\rho_{021} = \rho_{031} = \rho_{032} = 0$) 2194.4, $P < 0.001$. Significance: +10% level, *5% level, and **1% level.

Results for the alternative specification with HPWS domains in place of the HPWS index are shown in Table 7. Recruitment and selection practices were positively and significantly associated with new technology adoption and new service introduction, as predicted. However, training and development practices had non-significant effects, contrary to prediction. The effects of participation practices were weaker than expected in this analysis, being positive and significant (at the 10% level) only in regard to changes in working time arrangements.

5.3 Panel analysis

The subsample of WERS11 cases with linked data to WERS04 permitted a two-period panel analysis. For the financial ratings and the workplace change index, this took the form of a linear FE regression, while the conditional logit model was applied to each of the three change outcomes discussed in Section 5.2. Information on the workplace wage distribution was too limited in WERS04 to permit credible derivation of the median wage in the earlier year.

There are several points to be noted about this part of the analysis. Questions about HPWS, though covering the same field in 2004 as in 2011, were sometimes posed in a slightly different form, or with different wording, in the two surveys. In our judgement, this did not seriously affect the across-years meaning of the index. (The TS index was identical across years.) Size, unionization, and compositional variables were retained as controls, but age of workplace and industry group were omitted: for these, observed changes over time were suggestive of response or coding error, so we treated them as constant. For conditional logit models, the compositional controls were further simplified in order to limit sample loss. Analyses were run unweighted, as the available panel weights were unsuitable for analysis focusing on year 2011 (see Forth, 2013, p. 18).

FE linear regression estimates are shown in Table 8 for (panel a) the managers' subjective financial performance ratings, and (panel b) the summative index of workplace change activity. The effects of HPWS in both analyses were positive and significant. The effects of TS on financial performance ratings, that were positive and significant in the 2011 cross-

Table 8. FE panel regression estimates of HPWS and TS effects

Outcome	a. Financial rating		b. Change index	
	<i>b</i>	s.e.	<i>b</i>	s.e.
Unweighted				
HPWS	0.031	0.015*	0.069	0.020**
TS	0.001	0.023	0.118	0.040**
N (observations)	493		552	
R-square within	0.040		0.146	
Rho	0.423		0.453	

Source: Own analysis of WERS2004 and WERS2011 public use datasets.

Notes: Unweighted two-period (2004, 2011) panel estimates with robust variance estimator; see text, Section 5.3, for details of control variables. Significance: * 5% level, ** 1% level.

Table 9. Conditional logit estimates of HPWS and TS effects on three types of change

	New technology	New services	Working time
HPWS	0.027 (0.041)	0.148 (0.045)**	0.062 (0.038)
TS	0.087 (0.065)	0.103 (0.056) ⁺	0.093 (0.059)
N (groups)	83	110	115
LR chi-square (7 d.f.)	4.57	30.16**	10.48
Log-likelihood	-55.25	-61.16	-74.47

Source: Own analysis of WERS2004 and WERS2011 public use datasets.

Notes: Unweighted two-period panel estimates with observed information matrix variance estimator; controls are size; occupational, female, and part-time percentages. Significance: ⁺10% level, * 5% level, and ** 1% level.

section, became negative and non-significant in the panel, but a positive and significant effect appeared with the index of change activity.

In pursuit of a more detailed analysis of change activity, we re-focused on the three types of change that were examined in Section 5.2. Table 9 shows conditional logit FE estimates for these three change activities. However, loss of sample under the conditional logit model (even with a slimmed-down set of control variables) rendered the analysis for the new technology outcome unreliable, and the same difficulty also affected the other two analyses albeit less severely. HPWS had a positive and significant effect (5% level) on the technology-based or extended services outcome, whereas TS effect was significant at the 10% level. Conversely, TS had a positive effect, significant at the 10% level, on change projects with respect to working time, where the HPWS effect was smaller and non-significant.

Overall, despite being reliant on fairly small sample sizes, the FE analyses provided reasonably strong evidence that HPWS effects were robust to elimination of constant-over-time unobserved effects. However, it was not possible to conduct this type of analysis for the median wage outcome, and one should also exercise caution because of the various detailed issues that arose in specifying variables for panel analysis, rendering comparisons with the cross-section hazardous.

5.4 Further robustness checks

In a variant specification omitting TS, the estimated effect of HPWS on the (log) median wage was unaffected in magnitude and significance ($b = -0.006$, $|t| = 2.43$). However, in

the case of the financial performance rating, omission of TS from the specification led to considerably larger and more significant estimates of the HPWS effect ($b = 0.027$, $|t| = 2.46$). Thus, the median wage measure appears less sensitive to omitted variable bias. Omitting the TS term from the trivariate probit analysis resulted in considerable inflation of the estimates for HPWS: for the new technology outcome, the increase was 35%, and for the new services outcome it was 65%; the HPWS association with change in working time was also somewhat more positive but remained non-significant.

Variant specifications including a term for HPWS-squared did not provide evidence suggestive of non-linearity of effect with any of the outcomes in the linear models. Modeling the financial rating outcome as an ordinal response (ordered logit analysis) yielded results that were qualitatively similar to those treating the response as cardinal. Thus, a linear specification for HPWS appears robust. Tabulated results are available on request, or can be obtained via use of the replication files.

6. Conclusions and discussion

The primary question that has been posed in this research is whether HPWS is positively associated with performance in the public sector. The results provide substantial evidence that this is so. Cross-sectional analysis for year 2011 links HPWS intensity to reduced median wage at the workplace and to increased incidence of new technology adoption, and of introduction of services involving new technology or new methods. Longitudinal data analysis over years 2004 and 2011 show variation in HPWS intensity associated with more positive ratings of relative financial performance by managers and with the extent of change adoption over five types of change initiative. These findings lend some support for the proposition that, by adopting HPWS consistent with the NPM ethos (Bach and Kessler, 2008), public sector workplaces can achieve performance gains.

In parallel with estimating the overall HPWS effect, we investigated the separate effects of HPWS domains (these analyses were confined to the cross-section data). Results here only partly conformed to our predictions. Higher intensity of participation practices was associated with a reduced median wage and with more positive management ratings of performance, but relationships with change activity were absent or weak. None of the other HPWS domains contributed independently to financial outcomes and while the recruitment/selection domain was as predicted linked to two change outcomes involving new technology, corresponding effects for the training and development domain did not appear. The overall index of HPWS intensity appears to remain the strongest measure, as suggested by (for instance) Becker and Huselid (2006).

The research conceptualized HPWS as an aspect of 'management technology' (following Bloom, Sadun, and Van Reenen (BSV), 2017). To develop this approach, we introduced a measure of TS alongside HPWS. TS intensity was positively associated in the cross-section with managers' ratings of financial performance and with three types of change initiative; while in the longitudinal analysis it was positively associated with extent of change indexed over five types of change initiative. This somewhat confirms the heuristic value of the management technology concept in research on the HPWS-performance relationship. Moreover, variant analyses with TS excluded from regressors in several cases led to inflation of the HPWS estimates (indeed, only the median wage analysis was robust to this exclusion). This suggests that it will be worthwhile developing other management technology

measures along the lines of TS in order to reduce omitted variable bias in HPWS research (see also Gerhart, 2013).

The variant analyses with/without TS were one of several ways in which the research sought to test robustness in the HPWS-performance relationship. Of these the longitudinal data analysis was most important, in showing that several effects on performance were maintained when unobserved FEs were eliminated. Research in this field would be considerably strengthened if panel data or repeat cross-sections, on shorter time intervals, were available. That would offer some prospect of finding exogenous shocks to identify the HPWS effect more tightly.

Supplementary material

[Supplementary material](#) is available online at the OUP website.

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