The Pissarides Review into the Future of Work and Wellbeing

Briefing Paper

What impact does exposure to workplace technologies have on workers' quality of life?

March 2024

Institute for the Future of Work
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Nuffield Foundation

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Institute for the Future of Work

The Institute for the Future of Work is an independent research and development institute exploring how new technologies are transforming work and working lives. We develop practical solutions to promote people's future wellbeing and prosperity. Co-founded by former employment barrister Anna Thomas, Nobel prize-winning economist Professor Sir Christopher Pissarides and technologist Naomi Climer CBE, we work at the intersection of government, industry and civil society to shape a fairer future through better work.

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Introduction: why we need to understand how technology impacts workers' wellbeing

How people feel about work is important. Work is more than the single most important determinant of living standards. Work is the thread that connects individual lives with their communities and the economy. Work can promote social relationships, forge connections of mutual support and foster collaboration, binding together our capabilities with the environmental conditions that can either promote - or diminish - individual and collective flourishing. **Work and wellbeing are inextricably connected - and as we shape the future of our work, we shape the future of our wellbeing too.**

However, research and public policy have tended to treat technology and wellbeing separately, and disproportionately focus on job loss and employment. **Far less attention has been given to how workplace technologies are impacting job quality, and workers' quality of life.**

In practice, beyond job loss, there are a range of types of automation which affect risks and impacts to job quality and quality of life in varied ways - including how different people experience them, and where they are experienced (Gilbert, 2023). This means that the same technology can have both positive and negative impacts. Some newer technologies improve the flexibility of work arrangements - while also increasing surveillance, which is experienced negatively. It follows that technological and workplace transformations will change the quality of our work and lives in many and varied ways.

Looking into the past, **concepts of wellbeing have tended to be poorly and inconsistently conceptualised**, resulting in, for example, general findings about 'stress' or 'burnout', with little insight into the causes of consequences of that stress. **Past studies have also tended to take a narrow view of technology types**, making it harder to disentangle these links, or their interaction.

It is important that these factors are unpicked and highlighted to policymakers and business leaders. Among other reasons, people are highly likely to interact with innovative technologies and experience significant impacts from them in the high-stakes environment of work. **It follows that having a better understanding of positive and negative impacts on workers, their variation and the different trade-offs, is vital if we are to have a workforce that is healthy and happy – shaping better outcomes for everyone.**

This briefing outlines new work that has been done for the IFOW Pissarides Review into the Future of Work and Wellbeing to meet these significant evidential and policy challenges and improve our understanding of exposure to new workplace technologies.

Based on a sample of nearly 5000 UK employees, it has, for the first time, explored how exposure to AI software, digital ICTs, wearables and robotics correlate with the most widely accepted, multidimensional measure of health-related quality of life: EuroQol EQ-5D-3L.

This briefing focuses on exposure to new technologies and quality of life. A second brief, forthcoming, will focus on the relationship between technology exposure and quality of work.

Headline findings

The quantitative research dimension of this briefing is based on an online survey conducted between 22 May and 30 June 2023. A valid sample of 4802 employees was taken, representative of the UK working population in terms of age, gender, education and employment status. Non-proportional quotas were set on the number of participants in each of the 12 International Territorial Units Level 1 (ITL1) in the UK to allow for in-depth geographic analysis. The study received ethical approval from the Humanities and Social Science Research Ethics Committee (HSSREC) of the University of Warwick, UK.

Headline findings from the survey include that:

- **Significant variation in employees' quality of life correlated to increased levels of exposure to different workplace technologies.**
- **Quality of life improved as frequency of interaction with ICT such as laptops, tablets, smartphones and real-time messaging tools increased.**
- **Quality of life negatively correlated with frequency of interaction with newer workplace technologies such as wearables, robotics, AI and ML software.**
- **Perceived rights at work, and HR philosophies that emphasise employee wellbeing, have a positive correlation with quality of life.**

Digging deeper into the positives:

- **The positive association between the use of ICT and workers' quality of life persisted even when accounting for institutional and individual factors.**
- **This is consistent with research that connects such tools to enhanced work efficiency, motivation, communication with co-workers and higher job satisfaction - but further research on the mechanisms underlying this relationship is needed.**

Digging deeper into the negatives:

- **The negative association between the use of newer workplace technologies and workers' quality of life remained constant, even after accounting for other factors.**
- **This is consistent with research that connects such technologies to exacerbated feelings of disempowerment, increased sense of insecurity, task intensification and stress and loss of meaning, as well as anxiety and poorer overall health.**

Key implications for policy and practice

Our research suggests that:

- **Human flourishing and wellbeing should be an overarching, cross-cutting objective.** This should actively inform the development and deployment of automation technologies to minimise negative and maximise positive impacts experienced at work.
- **Better and more accessible data, measurements, methods and reporting on the evaluation of impacts on work quality, life quality and wellbeing are required.** To inform policy more closely, these should extend to multi-dimensional indicators of wellbeing to complement subjective indicators.
- **A 'one-size-fits all' view of workplace technologies is insufficient.** Newer technologies are impacting UK workers in complex ways which must be understood properly, and then monitored on an ongoing basis.
- **Those affected should be involved in the assessment and monitoring process so that different experiences of exposure, trade-offs and cumulative impacts can be taken into account.** A rigorous, systematic and participatory approach is needed to ascertain positive and negative effects, and their interaction.
- **Access to relevant information and consultation is essential through the automation process, especially when AI and newer technologies are adopted.** This underpins best practice and better outcomes and will be necessary to ascertain new, unexpected and changing experiences.
- **Workplace protection and perception of rights are associated with better quality of life.** These are therefore likely to play a valuable role in moderating positive perceptions of technology, increased trust and better outcomes.
- **Policies should incentivise and otherwise support firms to promote positive impacts on wellbeing, especially when AI and newer technologies are adopted.** Policies are needed to require appropriate mitigation of adverse impacts. A sharper focus on good work and wellbeing should help operationalise this goal.

A future of 'good automation' is possible, with new technologies improving job quality, life quality and wellbeing, but this will take concerted action and alignment across different departments and domains.

1. What have previous studies found, and what does this study do differently?

This work, for IFOW's Pissarides Review, is the first time that workers' wellbeing, capabilities, and exposure to technology have been triangulated. This provides a more granular understanding of technology impacts than has been possible in the past.

Supporting it are two previous papers published in the Review, as well as a section in the survey report (Soffia, 2024) scoping what is already known in this area of study. The first of the additional papers, ***What do we know about automation at work and workers' wellbeing?*** (Rohenkohl & Clarke, 2023), is a literature review. The second, ***Automation risk and subjective wellbeing in the UK*** (Zheng, 2024), uses longitudinal data and a fixed-effects model to examine associations between working in a highly automatable job, and life and job satisfaction.

Summary of findings from previous studies

Studies focusing on the relationship between *risk of automation* and *subjective wellbeing* generally indicate a negative relation between job satisfaction and high automation risk (Rohenkohl & Clarke, 2023). Employees in highly automatable jobs report significantly lower job satisfaction, a result that holds across gender, age and education, with higher negative association among men, higher degree holders and younger workers (Zheng, 2024).

A limited subset of literature suggests there may be positive effects of specific technologies on worker wellbeing. Communication technologies facilitating remote work have been linked to increased happiness, and internet usage during work can enhance job satisfaction. However, ICT and email usage have also been correlated with elevated employee stress and work intensification, and increased internet usage and screen time at work associated with sedentary behaviour and a higher risk of physical health (Soffia, 2024).

Ultimately, the magnitude and direction of the relationships observed seem to depend on what technologies are being studied, whether technologies are changing central tasks of a job or marginal tasks, and who is expected to be affected by these changes (Rohenkohl & Clarke, 2023).

Because they are easier to measure, many studies have relied on unidimensional subjective indicators like job satisfaction and overall life satisfaction, which cannot be decomposed into key determinants. As with wellbeing, most past studies have taken either a narrow view of technology types, or have focused on technology as a broad and undifferentiated resource.

What does this study do differently?

To provide a broader understanding of the impacts of technology on workforce health and wellbeing, this paper uses **a more robust multidimensional measure of wellbeing**, namely health-related quality of life as measured by the EQ-5D. It also uses **a multi-dimensional measure of technology exposure**, with participants asked about their interaction with four types of technologies in the context of their work.

2. Survey methodology

Survey participants

An online survey ran between 22 May and 30 June 2023 targeted at adults aged 18 and above who are currently in paid work and were resident in the United Kingdom. The analysis outlined in this briefing was based on a sample of n = 4,802 employees with complete information for all the relevant variables being analysed.

The sample was designed to represent the working adult population across the UK in terms of age, gender, education and employment status. In addition, non-proportional quotas were set on the number of participants in each of the 12 International Territorial Units Level 1 (ITL1) in the UK to allow for in-depth geographic analysis.

Measures

The measure of **wellbeing** used in this study is the EQ-5D-3L (EuroQol Group, 1990; EuroQol Research Foundation, 2018), which measures health-based quality of life across five dimensions: mobility, self-care, usual activities, pain/discomfort, and anxiety/depression (Figure 1). Each dimension has three response options: 1=no problems, 2=some problems, and 3=extreme problems.

To measure **technology exposure**, participants were asked about their interaction with four types of technologies in the context of their work ('In the course of your job, in a typical work week, how often do you interact with the following technologies?'), and these were answered on 5-point scales ranging from 1 ('never') to 5 ('always'):

- ***Digital information or communication technologies*** *'ICTs'* (for example computers, laptops, tablets, and smartphones, real-time messaging tools, as well as other devices that connect to the internet).
- ***Wearable and remote sensing technologies*** (for example, CCTV cameras, proximity cards, fitness trackers, smartwatches, smart glasses, GPS devices, and other sensors that gather data).
- ***Software technologies using artificial intelligence (AI) and machine learning (ML)*** (for example, advanced data analysis and programming software, text mining, natural language processing, speech recognition, image recognition, biometrics, decision management, touchscreen ordering, self-checkouts).
- ***Automated tools, equipment, machines and robotic technologies*** (for example, autonomous robots, self-driving vehicles, drones, handheld monitors or scanners, measuring and diagnostic devices or robots, 3D printers, lasers, CT scans, smart whiteboards, and other technologies that can automate physical processes).

This measure of technology exposure and the selected categories were devised following expert consultation and a review of existing survey items used in international and national surveys such as Digit's Employers' Digital Practices at Work Survey (Stuart et al., 2023), the Algorithmic Management and Platform Work Survey (Fernández-Macías et al., 2023), the Second European Skills and Jobs Survey (Cedefop, 2022), the German Linked Personnel Panel Survey (Ruf et al., 2020), the Investment in Work Technology Survey (CIPD, 2019), and the PIAAC Survey of Adult Skills (OECD, 2016).

Four additional independent variables were included to account for **institutional supportive resources** that, as reported in the literature, can change how technology is received by workers, thus influencing wellbeing outcomes: HR philosophy, training intensity, voice strength and rights at work.

Lastly, the following socio-economic and demographic characteristics of employees were included in the analysis to account for potential inequalities on the use of different technologies as well as on the impact on quality of life: gender, age group, ethnic background, salary band, qualification, occupation, industry and region.

Figure 1 - The EuroQoL Descriptive System

Mobility
1. No problems in walking about
2. Some problems in walking about
3. Confined to bed
Self-Care
1. No problems with self-care
2. Some problems with washing or dressing myself
3. Unable to wash or dress myself
Usual Activities
1. No problems with performing my usual activities (e.g. work, study, housework, family or leisure activities)
2. Some problems performing my usual activities
3. Unable to perform my usual activities
Pain/Discomfort
1. No pain or discomfort
2. Moderate pain or discomfort
3. Extreme pain or discomfort
Anxiety/Depression
1. Not anxious or depressed
2. Moderately anxious or depressed
3. Extremely anxious or depressed
Note: For convenience each composite health state has a five-digit code number relating to the relevant level of each dimension, with the dimensions always listed in the order given above. Thus 11223 means:
1 No problems walking about 1 No problems with self-care 2 Some problems with performing usual activities 2 Moderate pain or discomfort 3 Extremely anxious or depressed

Source: Dolan (1997)

Descriptive statistics were first used to demonstrate the incidence of using different workplace technologies in the overall sample and by relevant sub-groups. Next, to describe the raw associations between technology exposure and wellbeing, means and medians were computed along with measures of dispersion (standard deviations and interquartile range) for quality-of-life across sample groups and types of technology users.

Finally, a standard OLS regression was conducted to determine whether specific types of technology were correlated with quality of life after accounting for the covariates listed in the previous section. The linear regression has the form:

$$QualityOfLife_i = \beta_0 + \beta_j TechnologyExposure_{ij} + \beta_k X_{ik} + \varepsilon_i$$

Where:

- $QualityOfLife_i$ represents the quality of life score for the i^{th} worker (dependent variable).
- β_0 is the intercept of the model.
- $TechnologyExposure_{ij}$ represents the exposure to various technologies for the i^{th} worker, with j indexing the specific type of technology exposure (i.e. digital, wearables, AI software, robotics).
- β_j are the coefficients estimating the impact of each type of technology exposure on the quality of life score.
- X_{ik} is a vector of other independent variables that affect the quality of life of the i^{th} worker, with k indexing these other variables, namely: gender, age, ethnicity, region, income, educational attainment, occupation, industry as well as institutional factors including human resource philosophy, rights at work, training intensity and voice strength.
- ε_i is the error term for the i^{th} worker, capturing all other factors that affect quality of life and are not included in the model.

3. Key survey findings

Prevalence of technology exposure in the sample

Over 60% of respondents reported interacting with digital ICTs often or always.

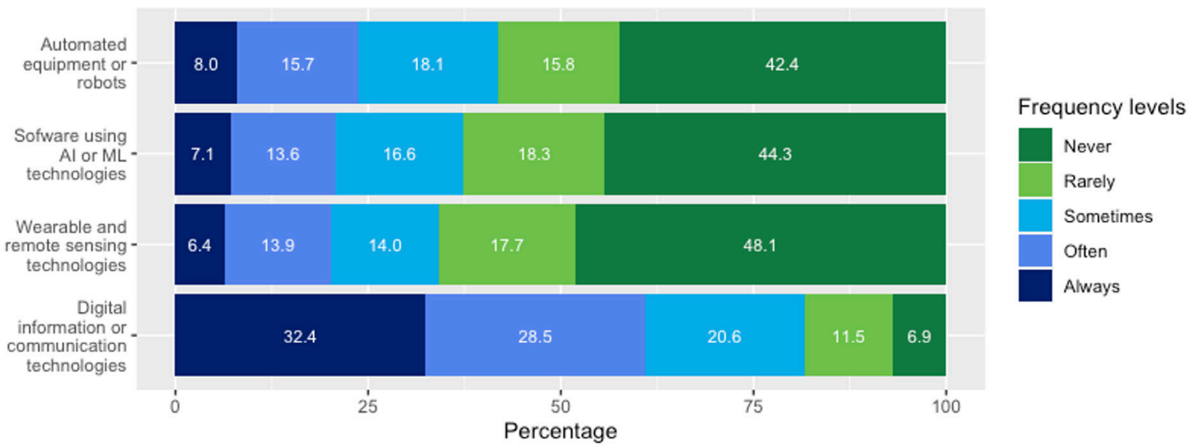
Under 25% of respondents often or always interacted with newer types of technology: 20.2% with wearables, 20.8% with AI software and 23.7% with robotics.

Wearable and remote sensing systems were the least often used, with nearly 50% of respondents reporting they 'never' interact with such systems.

50.8% interact with two or more of these technologies at least sometimes

18% say they interact with all four types of technology at least sometimes.

Figure 2 -Sample distribution by frequency of use of workplace technologies ('How often do you interact with the following technologies?').



Note: Weighted data and complete cases (n=4,802)

Occupational Variability

The use of digital ICTs followed a **distinctive occupational gradient:** managerial, professional and associate professional employees interact with these types of technologies more often than those in operative and elementary occupations.

All newer technologies were most reported by skilled trades workers, then by managers and professionals. Workers in sales and customer service were as exposed to sensor, AI and robotic technologies as those in professional occupations. Interaction with robotics was also frequently reported by plant and machine operators.

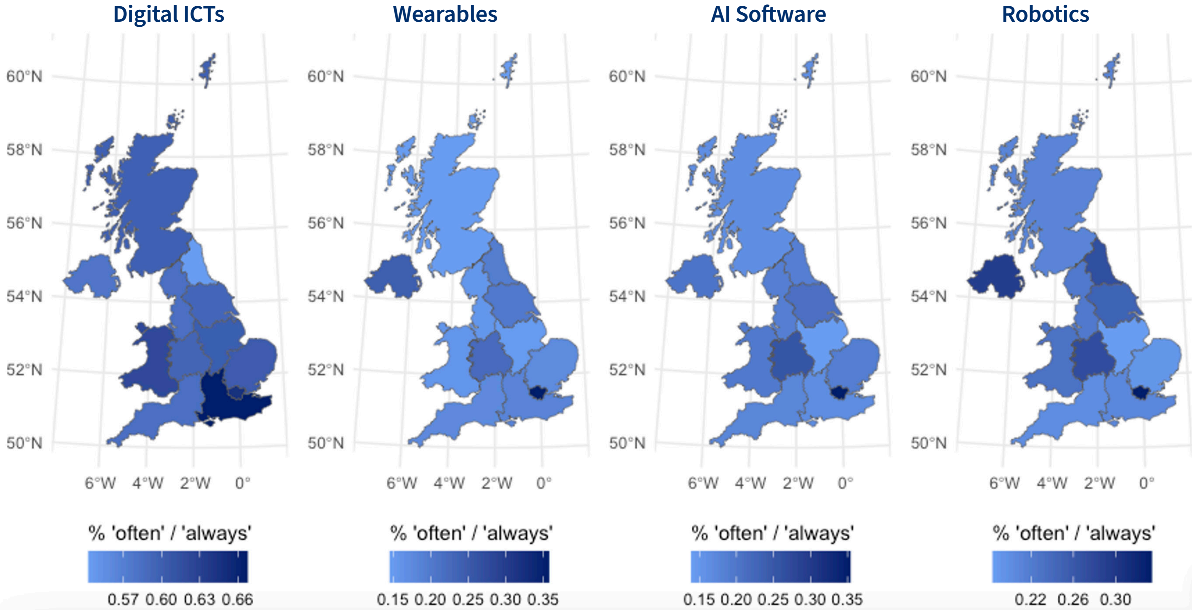
Geographic variability

The incidence of digital ICT exposure did not vary significantly by region

Exposure to newer technologies was markedly higher in London, followed by the West Midlands and Yorkshire and The Humber.

Participants in the Northeast reported significantly higher interaction with robotics.

Figure 3 - Proportion of respondents reporting frequent interaction with technologies, by type of technologies and UK region.



Note: Weighted data and complete cases (n=4,802)

Technology exposure and quality of life

Bivariate analysis

Men and women reported the same quality of life levels as the overall sample but notably higher than those identifying as other genders (MD=0.632, IQR=0.484).

Quality of life scores decreased with age, with the lowest medians recorded in the 50-64 and 65+ age groups (MD=0.761, IQR=0.302 to 0.310).

No significant ethnic differences, with the median scores of white participants and those of Asian, Black, and Mixed ethnic backgrounds being similar.

Higher earnings correlate with better reported quality of life, with those earning £74,101 per year or over displaying the highest scores (MD=1.00, IQR=0.239).

Northern Ireland, Scotland, Yorkshire and the Humber, and East Midlands report significantly lower quality of life scores (MD=0.761, IQR=0.310 to 0.316).

- **Frequent users of digital ICTs report higher quality of life** than no users (MD=0.782, IQR=0.302 for 'Always').

- **Frequent users of wearables report lower quality of life scores** (MD=0.752, IQR=0.432 for 'Always') than no users. Similarly, frequent users of AI software or robotics report lower quality of life (MD=0.761, IQR=0.360 and 0.341 respectively for 'Always') than those with less frequent exposure.

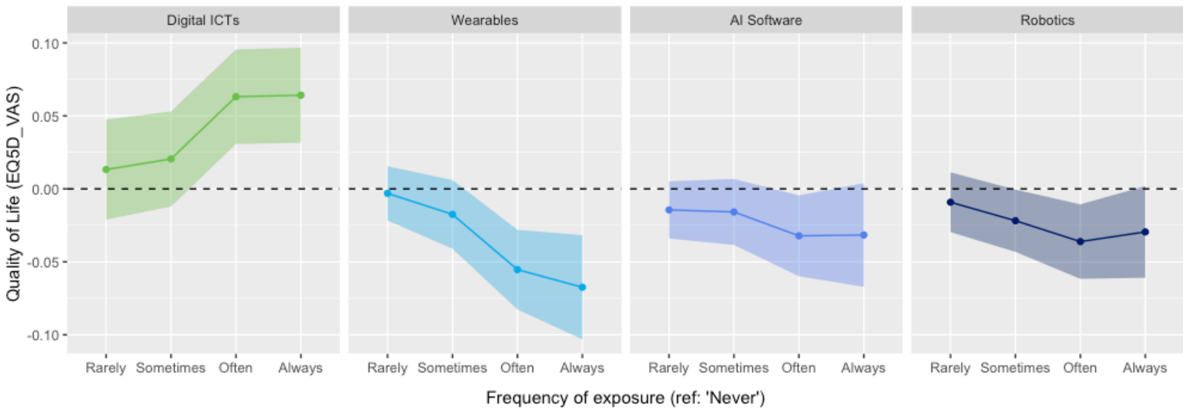
Multivariate regression results

Frequent interaction with digital ICTs positively correlates with enhancements in quality of life, with coefficients of 0.063 (SE = 0.016) for 'Often' and 0.064 (SE = 0.017) for 'Always', both at a significance level of $p < .001$.

In contrast, **frequent engagement with wearables, AI software, and robotics exhibited a negative relationship with quality of life**. Most notably, 'Always' use of wearables showing a coefficient of -0.067 (SE = 0.018, $p < .001$).

Moderate exposure to robotics also revealed an adverse effect on quality of life.

Figure 4 - Average marginal effects of technology exposure on quality of life with 95% confidence intervals.



Analysis of the institutional support factors explored in the survey found:

HR philosophies that emphasise employee wellbeing over productivity have a positive correlation with quality of life, corroborating the literature that highlights the beneficial effects of such an approach (e.g. Gilbert et al., 2022; Hayton, 2023)

Employees' perceptions of their rights at work were linked to improved quality of life, supporting assertions from previous studies regarding the importance of these contextual factors.

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The Pissarides Review into the Future of Work and Wellbeing

Automation technologies are transforming work, society and the economy in the UK in ways comparable to the Industrial Revolution. The adoption of these technologies accelerated through the COVID-19 pandemic, and the ongoing impact of automation is unevenly distributed, with a disproportionate impact on demographic groups in lower pay jobs.

IFOW's Pissarides Review into the Future of Work and Wellbeing - led by Nobel Laureate Professor Sir Christopher Pissarides, is researching the impacts of automation on work and wellbeing, and analyse how these are differently distributed between socio-demographic groups and geographical communities in the UK.

For more information on the Review, visit: pissaridesreview.ifow.org

If you have a professional or research interest in the subject of the impact of automation technologies on work and wellbeing and have insights to share, please contact Abby Gilbert, Director of Praxis at the Institute for the Future of Work at abby@ifow.org

If you are a member of the press and have an enquiry or would like to receive new press releases by email, please email Kester Brewin, Head of Communications at the Institute for the Future of Work at kester@ifow.org