Briefing Paper

What impact does exposure to workplace technologies have on the quality of people's jobs?

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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 MBE, 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 job quality

How people feel about the jobs that they do is important. Our work is more than the single most important determinant of our living standards. Work is the thread that connects individual lives with their communities and the economy. Work promotes social relationships, forges connections of mutual support and fosters 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.

In the Briefing that we published in March, we outlined research that shows that the growing use of technologies in the workplace is having significant, measurable and varied impacts on employees’ wellbeing.

Exposure to digital ICTs such as laptops, tablets and smartphones was associated with higher quality of life, while exposure to other technologies such as wearables, AI software and robotics was negatively correlated with wellbeing (Soffia et al. 2024).

However, the mechanisms behind these associations have not been well explored. If we know that exposure to new technologies is impacting workers’ wellbeing, we need to understand how this is happening to inform what we do about it. In particular, we need to know how these technologies are interacting with job quality changes, and therefore impacting good work.

This Briefing adds to the work on wellbeing by providing a more nuanced understanding of the mechanisms by which exposures to workplace technologies may be connected to quality of life – of which job quality is a main contributor.

We know that the concept of ‘job quality’ has a significant association with the wellbeing of the person performing that job. Measurement of job quality has extrinsic aspects such as salary and future job prospects, but it also has intrinsic dimensions such as work intensity, autonomy, work environment and working time arrangements. At IFOW we have developed a ‘Good Work Charter’ to capture this multi-dimensional construct, including the extrinsic and intrinsic dimensions of job quality, offering clear pointers as to what good quality work should look like and a framework against which impacts can be considered.

While it is both valid and necessary to monitor variations in workers’ wellbeing, from a practical policy perspective it is easier to design policy mixes and target actions towards improving job quality – with an understanding that improvements here are likely to convert into improved quality of life.
What we find here is that the feelings of persistent job insecurity that new technologies bring cancel out many of the potential job quality gains, unless such downsides are consciously managed.

In addition, the promise that AI and automation technologies would relieve people of routine work is found to be lacking substance, diminishing hopes that these new technologies inherently improve job quality in itself. This adds weight to calls for more attention to be made to choices that shape job quality impacts when new technologies are adopted, right from design through development and deployment.

Research in other parts of the Pissarides Review into the Future of Work and Wellbeing has shown that these approaches to how AI and automation technologies are designed, developed and deployed do shape job quality; what this work adds is understanding the extent to which exposure to these different technologies increases or reduces job quality – and how these impacts might be different for different social groups or different roles within a firm.

The basis of the study was primary survey data analysed from a sample of nearly 5,000 employees. An online survey was 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.
Headline findings

Over the past three years and because of technology at work, employees report:

- greater opportunities to learn new things and apply their own ideas
- greater flexibility of work location
- stronger feeling that they are doing useful work
- better job prospects.

However, over the same time period, they also report:

- less job security
- intensified pace of work and increase in volume of tasks
- much more surveillance
- more routine and repetitive work
- working more often at night and over weekends
- diminished sense of health and safety
- more abusive behaviour from customers.

The impact of technology on job quality is thus tending to be divergent: there are significant benefits, but these come with associated risks and impacts. Most importantly, the persistent sense of job insecurity could well weigh more than any gains in salary progression.

Digging into more detail:

- those working with Digital ICTs – laptops, tablets and smartphones - are more likely to report better job security, more decision-making power, better health and safety and flexibility, and a very significant increase in the chance of reporting more learning opportunities
- those from ethnic minority backgrounds* are more likely to report that technology has improved their career prospects and made performance evaluations fairer - as well as protecting them from abuse by customers
- nearly a third of all employees report that ‘technology’ – broadly defined – has increased repetition and routinisation in their work
- there is growing pressure to upskill - but few financial rewards for doing so
- frequent use of wearables was associated with worsening exposure to abusive behaviours. However, wearables also showed a positive association with better salary, more consistent work scheduling, and more meaningful work.
- however, all newer technologies - wearables, AI software and robotics – are reported to be contributing to greater concern about exacerbations of job insecurity, increasing the feeling that an employee will lose their job or become unemployed in the next six months.

*White ethnic minority groups were incorporated into the ‘White’ category*
Key implications for policy and practice

Our research across the Pissarides Review demonstrates that work quality, design and the workplace environment are key to achieving good outcomes from technology use at work. These are also outcomes and conditions of good, human-centred technology use, which is associated with high levels of wellbeing and life satisfaction.

This work adds weight to that argument, and suggests that:

- **A new focus on work quality, in particular, will help reconnect policy with the workplace and the productive process, demonstrating that these should not be seen as ‘black boxes’.** Good Work should become a cross-cutting policy objective and priority across different departments and tiers of government as soon as possible, from procurement to new measures for evaluation.

- **The survey reveals that a baseline of employee-centred HR policies and the perception of rights is associated with better work quality and wellbeing in the context of technology use at work.** This supports the introduction of an Employment Bill to update labour law, including specific protection of key areas highlighted in our analysis of the survey, including: impacts, anticipated impacts and variations in pay, terms and conditions, job quality, working time, flexibility and disconnect from digital communications.

- **Going further, people’s perception, understanding and trust of new technologies, especially perceived risks to work security, are as important as ‘automation risk’.** This finding invites much more attention is given to building and sharing information and direct involvement in the automation process. We anticipate that these new rights and responsibilities will be an integral part of managing equitable workplace transitions, in ways which maximise and spread benefits for employers and employees alike.

- **The research also invites higher levels of involvement in the process of automation and design of work, as well as the assessment and monitoring of impacts on work quality.** Together, these point to additional, explicit transparency and monitoring obligations. This is particularly important in relation to AI, which is associated with new, unexpected and changeable experiences.

- **In this context, the scale of the highly divergent impacts on good work when newer technologies like AI and wearables are deployed is striking and reflects the tendency of new technologies to divide, scale and spillover.** Importantly, notwithstanding its potential, the persistent feeling of job insecurity that those exposed to these technologies report may well outweigh the positive impacts.

- **Further, the potential to exacerbate intersectional inequalities is highlighted throughout the analysis, as well as the fear that existing inequalities may become more pronounced.** This points to a need to update the Equality Act to allow for early disclosure, monitoring of cumulative, new and changing impacts on good work, and intersectional discrimination.
• The finding that adopting workplace technologies leads to divergent outcomes – with many positives and negatives within and between groups – affirms that a 'one-size-fits all' view of workplace technologies is insufficient. Newer technologies are impacting UK workers in complex ways – with different interactions playing out in different job roles at different pay levels for those in different age brackets of different ethnicities in different parts of the country. These impacts must be pre-empted, managed, and monitored at the firm level, with, we argue, better ongoing measurement at a system level to ensure effective governance.

• 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.

• Because of the follow-on implications for socio-economic outcomes in local communities, policymakers and business leaders – as well as bodies representing employees – must take seriously the implications of expanding the use of these tools without a full and thorough assessment of their likely impacts on job quality.

• Further work must be done to establish what choices in the design, development or deployment of newer technologies is driving job quality impacts. For example, the findings on wearables worsening exposure to abusive behaviours but being associated with improvements in salary are likely to reflect different segments of the workforce, those subjected to - or electing to - use wearables. This will be explored in further work, but this work so far shows that rigorous, systematic and participatory approach is needed to ascertain positive and negative effects, and their interaction.

• The findings on digital skills have significant implications for policymakers, and for training providers. Better analysis is needed to evaluate uncritical claims of ‘digital upskilling’ and recognise where this might, for example, result in a reduction in discretion at work or have negative impacts on pay.

In summary, the twin effect of exposure to workplace technologies – with benefits married to significant negative impacts – highlights the divergent impact of these new technologies. This shows the vital importance of cautious attention being paid to job quality when their adoption is considered.
1. **Background: technology exposure and job quality**

Past research has shown how technology exposure is correlated with wellbeing, but that the direction of this correlation depends on the technology type. Exposure to digital ICTs like laptops and smartphones is correlated with improved wellbeing, while exposure to newer workplace technologies like wearables, AI software and robotics, is correlated with poorer wellbeing (Soffia et al. 2024).

Other work in the Pissarides Review has shown that employees in highly automatable jobs report significantly lower job satisfaction (Zheng et al., 2024). However, these analyses do not yet explain how exposure to different types of technology might affect job quality.

Beyond meeting purely material needs, job quality encompasses intrinsic dimensions that stress the wellbeing effects of good work. Though attempts to measure job quality robustly are relatively recent, the importance of doing so is emphasised by evidence that – next to health – it is the second most significant factor contributing to adult wellbeing.

However, the evidence about how technology impacts job quality is still emerging and varied, highlighting the complex associations between automation and improvements to working life. For instance, while income predictability is higher among workers using digital technologies, job insecurity also increases (Piasna, 2024).

Technology’s influence on working time and work intensity also varies, with digitisation often leading to ‘punctuated’ working time and increased work demands (Piasna, 2024). Work intensity rises alongside technology deployment. Moreover, while some technologies streamline tasks, others increase workload, with feelings of ‘incessant availability’.

Similarly mixed is the picture on worker autonomy. Algorithmic management systems can decrease control, but also enable flexible work arrangements (Brîone, 2017) and greater decision-making power on work scheduling, or reducing routine tasks. Increased seniority correlates with greater benefits here. Surveillance technologies affect workers’ perceptions of fairness and trust, with potential implications for mental wellbeing (Newman et al., 2020).

Where systems are well-designed, they can help improve a sense of meaningfulness of work. However, workers have been found to explicitly lack confidence in the ability of their employers to manage risks to their rights, including those relating to fairness (Gilbert and Thomas, 2021).

The literature thus shows that the impacts of technology on job quality (and thus wellbeing) are rarely isolated and direct. Technology changes work in ‘socio-technical’ ways, reflecting choices about design, development and deployment made by those who create these tools, and the firms who deploy them.

In practical terms, this means that the same technology can be designed and deployed to achieve very different automation purposes, with very different implications for job design and quality. For instance, an AI system can be used for surveillance to check – via facial
recognition - attendance at work, or sentiment analysis to detect fatigue. But the same system could help a worker improve discretion and save time through a ‘meeting summary’ function. Thus, classes or types of technology do not have homogenous impacts, they embed social choices about what and how work should be. This is what determines the outcomes.

In summary, the complex interaction between technology and job quality necessitates careful analysis. While technology adoption can enhance certain aspects of work, it also poses risks to worker wellbeing. Understanding these dynamics is critical for ensuring technology serves as an enabler of human flourishing amid ongoing technological transformation.
2. Survey methodology and data analyses

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
To measure technology exposure, survey participants were asked their degree of interaction with four types of technologies in the context of their main job on a typical working week. This was scored 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
Job quality was measured through 18 single items reflecting the various domains of job quality proposed by Green and Mostafa (see Eurofound 2012, 2017).

Table 1 - Measures of changes to job quality due to technology

<table>
<thead>
<tr>
<th>Dimension</th>
<th>I would like you to think whether, in the last three years, technology has changed your everyday work experience in any of the following ways.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pay</td>
<td>Due to technology, my salary has...</td>
</tr>
<tr>
<td>Job prospects</td>
<td>Due to technology, my prospects for career advancement or promotion have... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, the chances of losing my job or becoming unemployed in the next 6 months have... (*) </td>
</tr>
<tr>
<td>Skills use and discretion</td>
<td>Due to technology, my ability to influence decisions that are important for my work has... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, my opportunities to learn new things have... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, my opportunities to apply my own ideas at work have... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, the share of my work that is repetitive and routine has...</td>
</tr>
<tr>
<td>Intensity</td>
<td>Due to technology, the volume of my tasks and duties has...</td>
</tr>
<tr>
<td></td>
<td>Due to technology, my usual pace of work has...</td>
</tr>
<tr>
<td>Social environment</td>
<td>Due to technology, the amount of surveillance over my work or that of my colleagues has... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, my exposure to abusive behaviours from customers and people I work with has...</td>
</tr>
<tr>
<td></td>
<td>Due to technology, my opportunities to interact and communicate with the people I work with have... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, the accuracy and fairness of my performance evaluations/ratings/feedback has... (*) </td>
</tr>
<tr>
<td>Physical environment</td>
<td>Due to technology, health and safety risks at work have...</td>
</tr>
<tr>
<td>Time and place flexibility</td>
<td>Due to technology, the flexibility to choose my work location has... (*) </td>
</tr>
<tr>
<td></td>
<td>Due to technology, the frequency I work during unsociable hours like weekends and nights has...</td>
</tr>
<tr>
<td></td>
<td>Due to technology, the consistency and predictability of my working hours has... (*) </td>
</tr>
<tr>
<td>Meaningful work</td>
<td>Due to technology, my feeling of doing useful work has... (*) </td>
</tr>
</tbody>
</table>

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.

Descriptive statistics were first used to explore the distribution of the job quality data. Given that our dependent variable of changes in job quality can be considered to have a natural order ranging from ‘worsened’ (1) to ‘unchanged’ (2) and ‘improved’ (3), we adopted an ordered model approach.

Thus, in a subsequent step, a series of ordered logit regressions were conducted to determine whether specific types of technology were associated with changes in job quality, controlling for other factors (listed above). Following Williams (2006), these regressions have the following generic form:

\[
P(Y_i > j) = \frac{\exp (\alpha_j + \beta_1 Digital_i + \beta_2 Wearables_i + \beta_3 Software_i + \beta_4 Robotics_i + \beta'_k X_i + \epsilon_i)}{1 + \{\exp(\alpha_j + \beta_1 Digital_i + \beta_2 Wearables_i + \beta_3 Software_i + \beta_4 Robotics_i + \beta'_k X_i + \epsilon_i)\}}
\]

for \(j=1,2\) (n=3-1 levels of job quality, with category 1 as baseline).

Where:

- \(P\) is the predicted probability of an individual reporting a given level of job quality.
- \(j\) indexes the categories of JobQuality (1 for ‘worsened’, 2 for ‘unchanged’, 3 for ‘improved’)
- \(\alpha_j\) represent specific cut point for the \(j\)th level of job quality
- \(Digital_i, Wearables_i, Software_i, Robotics_i\) are the different types of technology exposure for individual \(i\)
- \(\beta_1, \beta_2, \beta_3, \beta_4\) are the coefficients for the technology exposure
- \(X_i\) represents a vector of control variables for individual \(i\)
- \(\beta_k\) are the coefficients for the control variables
- And \(\epsilon_i\) are the error terms

Prior to conducting the logistic regressions we confirmed there was little evidence of multi-collinearity. Robust standard errors were used in all regressions.

The dataset showing full ordered logistic regression results is available as a spreadsheet that can be downloaded [here](#).

This study received ethical approval from the Humanities and Social Science Research Ethics Committee (HSSREC) of the University of Warwick, UK.
3. Key survey findings

The overall picture

On the plus side, over the past three years:

- Nearly 60% of employees reported that, due to technology, they had opportunities to learn new things.
- Nearly half reported that technology had allowed them greater flexibility in choosing their work location.
- More than 40% reported that technology improved interaction and communication with people at work.

However, on the negative side, over the past three years:

- Over 40% reported increases in surveillance at work.
- Pace of work and intensification are reported to have risen significantly.
- The share of work that is repetitive and routine has also risen significantly.

These results are important. They show that, while there are distinct benefits being seen from the introduction of new technologies, these are being significantly weighed against negative impacts.

Technology adoption has a highly divergent impact on job quality.
Digital ICTs and job quality

The use of Digital ICTs is statistically associated with improvement in six job properties: job security, decision-making powers, increased learning opportunities, the chance to apply one’s own ideas, health and safety, and flexibility.

However, use is negatively associated with the prospect of career advancement – perhaps indicating that being skilful and proficient in Digital ICTs is becoming less valued in the labour market as newer technologies come on stream.

Figure 2 - Interactions with Digital ICTs and job quality changes, represented as percentage change from odds ratio (OR) = 1

Note: coloured bars represent associations significant at p < 0.05 (at p < 0.1 in the case of ‘chances of job loss’ and ‘decision power’, while greyed bars represent statistically insignificant associations.
Wearables and job quality

The use of wearables is highly divergent. Interaction with them is associated with reporting higher salaries, better career prospects and a more equitable work environment, fairer performance evaluations and predictable schedules.

However, their use is also associated with lower job security, repetitive work, greater work intensity, fewer health and safety improvements, less flexibility and more frequent unsociable hours worked.

![Figure 3 - Interactions with Digital ICTs and job quality changes, represented as percentage change from odds ratio (OR) = 1](image)

Note: coloured bars represent associations significant at p < 0.05 (at p < 0.1 in the case of ‘pace of work’, ‘surveillance’ and ‘workplace flexibility’), while greyed bars represent statistically insignificant associations.
AI and Machine Learning and job quality

Being knowingly exposed to advanced AI- or ML-based software at work is predominantly associated with positive changes in job quality. However, these observations are mediated by different sectors.

![Figure 4 - Interactions with AI software and job quality changes, represented as percentage change from odds ratio (OR) = 1.](image)

Note: coloured bars represent associations significant at p < 0.05 (at p < 0.1 in the case of ‘salary’), while greyed bars represent statistically insignificant associations.

Robotics and job quality

The deployment of robotics and automated equipment within the workplace appears less impactful than other technologies, as the multiple regression analyses yielded significant associations with only 5 aspects of the job when other factors are held constant.

![Figure 5 - Interactions with robotics and job quality changes, represented as percentage change from odds ratio (OR) = 1](image)

Note: coloured bars represent associations significant at p < 0.05 (at p < 0.1 in the case of ‘career prospects’ and ‘evaluation fairness’), while greyed bars represent statistically insignificant associations.
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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, Co-Director 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