

Digitalisation and the Future of Work

Introduction¹

Digitalisation is driving rapid changes in the nature, quality and productivity of work. European leaders face the challenge to make use of these developments to support economic growth, global competitiveness and sustainable innovation – while at the same time ensuring decent working conditions, social protection and equal opportunities for all.

In light of these ongoing changes, DG CONNECT has invested in a number of activities over the past several months, including:

- DG CONNECT (in cooperation with DG EMPL) convened a [group of 10 High-Level Experts](#) between September 2018 and February 2019. The group presented its [final report](#) to Commissioners Mariya Gabriel and Marianne Thyssen on 8 April 2019.
- The European Commission (DG EMPL, with the contribution of DG CONNECT and other DGs) organised the [high-level conference “Future of Work: Today. Tomorrow. For All.”](#) on 9 April 2019.
- In cooperation with the Centre for European Policy Studies (CEPS) DG CONNECT organised two meetings with key stakeholders on [April 8](#) and [May 3](#), in preparation of the [Digital Assembly on 13-14 June 2019](#).
- During the Digital Assembly, the “Digital4Jobs” theme was one of the key topics of discussion via a [technical workshop on June 13](#) and the dedicated [plenary session](#) on June 14.

This note provides a synthesis of these activities, with an aim to provide realistic but innovative policy recommendations within the scope of activities managed by DG CONNECT.

Affecting all citizens today and in the future

The following trends are affecting all citizens, workers, businesses and policymakers at private and public organisations today and in the future:

- **Societal trends that are interconnected:** The trends are
 - Digitalisation
 - Globalisation
 - Changing institutions, regulations and policies
 - Slowing population growth and workforce aging.

¹ This document was drafted by Prof Maarten Goos (Utrecht University, former Chair of the High-Level Group on the Impact of the Digital Transformation on EU Labour Markets) on the basis of the discussions held before and during the Digital Assembly 2019 (13-14 June 2019, Bucharest, Romania) including the workshops organized by Dr Andrea Renda and his team from the Centre for European Policy Studies. The information and views set out in this document are those of the author and do not necessarily reflect the official opinion of the European Union. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein.

These trends are interconnected. For example, digitalisation enables globalisation and the design of new policy instruments, or digitalisation can support businesses in coping with labour shortages due to slowing population growth and workforce aging.

It is important to realise that there are **multiple trends** currently driving societal change. For example, even if a decrease in average job tenure is only due to the rise of temporary work contracts, there could still be technological anxiety if people perceive their increased risk of job turnover as exclusively driven by digitalisation. Another reason why it is important to realise that there are several societal trends occurring simultaneously is that it determines the impact of policies. For example, employment subsidies for companies that innovate in new digital technologies might have little effect on increasing job tenure if at the same time it becomes easier for companies to offer temporary contracts to workers.

- **Disseminating facts to better inform citizens:** There is little doubt that digitalisation is key to rising living standards in the long-run. However, it is much less known that **digitalisation alone is creating over 1 million net jobs per year in the EU-28**. Also, new work arrangements (other than full-time permanent contracts such as temporary contracts or the online gig economy) are in large part taken up by workers that would have not participated in the labour market otherwise. Examples of other facts are that digitalisation is **increasing skill gaps**; is quickly **changing business models**; or is leading to **job displacement for some workers**. Disseminating these facts to all citizens will increase awareness about opportunities as well as challenges from digitalisation and help realise its potential.
- **Challenges for decision makers in public and private organisations:** Societal trends pose challenges for decision makers in public and private organisations. These challenges will become most urgent where several societal trends interact, such as early retirement due to rapid workplace digitalisation (**digitalisation & aging**), the emergence of online job platforms as a new labour market institution (**digitalisation & changing institutions**), or technology-induced job polarization that is taking place mainly in urban areas (**digitalisation & globalisation**).

At the level of workers and human resource policies, the main challenges relate to workers' skills to keep people employable in the future. At the level of businesses and labour relations, the challenge is to provide decent work by the creation of high-quality jobs and safeguarding worker wellbeing and a healthy work-life balance. Finally, for society as a whole, the challenge is to build a more inclusive society by preventing economic and social polarization.

Policy recommendations

Policy recommendations can be structured into three main categories:

- **A skilled workforce** – ready to contribute to tomorrow’s world of work
- **New work relations** – adapting structures to tomorrow’s realities
- **A new social contract** – upgrading the European social model

The remainder of this note discusses each of these in turn.

A skilled workforce – ready to contribute to tomorrow's world of work

The impact of digitalisation on employment should not be seen in terms of the number of jobs (e.g. there is no problem of “technological unemployment”), but it should mainly be seen in terms of the **quality of jobs**. A key determinant of job quality are worker skills.

The digital transformation is contributing to **skills shortages and mismatches** that require investments in full-time education and employee training. In light of these challenges, policies should focus on the following questions:

- (i) What are digital skills?
- (ii) Who should invest in digital skills?

What are digital skills?

Science, Technology, Engineering, and Math (**STEM**) is a term used to group together academic disciplines in full-time higher education. Workers with STEM degrees can enter STEM jobs that are key contributors to economic growth and competitiveness and are a leading edge of technology diffusion.

Yet **STEM workers are in short supply**. In part, this shortage of STEM workers exists because the content of STEM jobs changes quickly over time, leading to flatter age-earnings profiles as STEM skills of older workers become obsolete relatively quickly. For example, a programming language learned by a college student is likely to be superseded by a new programming language ten years later. One policy to address the STEM shortage therefore is to invest more on-the-job training for STEM workers, especially in those STEM skills that depreciate quickly.

The depreciation of (some) STEM skills over time also explains why many STEM workers exit their STEM jobs after some time, requiring other skills in their new jobs. For example, a STEM worker who is initially employed as a software coder is likely to also need management skills as her career progresses (and as her programming skills become partially obsolete because of technological progress in programming). This is consistent with the fact that employment and wage growth are particularly strong for STEM workers that also have good management skills.

These management skills include **social skills** (for managing teams) but also **other skills**. For example, they also include knowledge about how to use data to understand what works, what doesn’t and why. This requires knowledge of A/B testing (for causal inference), evaluating interventions using machine learning (to exploit big data) or a combination of both to optimize

company processes such as marketing or workplace organisation. Another skill that is in high demand is knowledge about the design of new markets (such as online markets and two-sided platforms) and how to incentivise users on those markets. This involves the design of pricing and allocation mechanisms (to engineer market thickness, congestion, and safety for users) as well as the design of reputation systems. Finally, an understanding of the competitive landscape of new markets is relevant, not only for managers at private companies but also for policymakers and regulators at public organisations. Currently, the shortage of these other skills is probably as large as that of STEM skills.

In sum, STEM skills are in short supply. In part, this is because (some) STEM skills depreciate relatively quickly on-the-job. One policy option therefore is to invest more in STEM skills through on-the-job training. It is also important to define **digital skills beyond knowledge about STEM disciplines**. For example, the notion of digital skills should also include knowledge about how to use data to evaluate interventions in a company's marketing or workplace organisation; about the design of new markets and how their users are incentivized; and about how these new markets are structured and what this means for competition and competition authorities.

Who should invest in digital skills?

Public and private institutes of full-time education have the expertise to teach STEM and complementary skills to young people, but they often lack the real-time knowledge of which skills are most demanded by employers and how these requirements change over time. Several options exist for policymakers to invest in specific STEM fields, provide incentives to schools to realign current investments in full-time education, and help schools to be better informed about changing skill needs.

Skill gaps also result from **underinvestment by workers and companies in on-the-job training**. Depending on the reason(s) for this underinvestment, several policies can help reduce shortages in digital and related skills:

- **If a worker's digital skills are valuable across companies, workers should mainly invest in them.** However, workers might not be aware of the benefits of investing in digital skills. If so, policymakers can organise **digital skills personal learning accounts**. Such accounts would belong to workers and would be portable from job to job. However, details such as contributions, number of hours per year, top ups, eligible expenses, withdrawal processes and taxing schemes are important and not much is known yet about their effectiveness. Pilot study (e.g. an A/B experiment) could be considered.
- **If a worker's digital skills have, in part, value only to a single company (e.g. knowledge to work with firm-specific software), not only the worker but also the company has an interest in investing in digital skills.** However, companies could underinvest in digital skills because **training costs are booked as costs in company accounts rather than being booked as investments** (and this might matter for e.g. shareholders). One policy solution would be to **provide tax credits** to employer-provided training programs. Moreover, these training programs can be organised as **mandated non-wage benefits** that are part of a worker's remuneration (i.e. wages plus non-wage benefits). If so, workers' wages will decrease, thereby sharing in the costs of skill investments.

- **Workers and employers can be discouraged to jointly provide digital training because of the temporary and flexible nature of employment relationships, especially in new forms of work.** The reason is that temporary contracts make it more difficult for workers and employers to commit to share the immediate costs as well as the future benefits of skill investment. Although skill investment would be beneficial to both workers and employers ex-post, a hold-up problem arises ex-ante leading to an underinvestment in digital skills. Importantly, **underinvestment in skills is due to a structural and persistent market failure in skill investment** instead of the temporary misalignment between the supply of and demand for digital skills (especially during economic upturns). Consequently, only **collaboration** with public or private third-parties (such as public employment services, outplacement offices or temporary help agencies) can help reduce skill gaps. Especially several policies that incentivize **private intermediaries** to help employers and their workers to invest in digital skills look promising and should be explored further.

It is important to ensure that these investments in workers' digital skills transcend into companies consolidating the knowledge required to be a successful employer. At the company level, this requires a focus on **career counselling** and creating **innovative learning environments** to enable better career choices and the active pursuit of relevant training programs for workers. **Career counselling could be supported through establishing digital training standards and digital literacy for career counsellors.**

Finally, **policymakers must ensure that training becomes accessible to workers that would otherwise not have access to acquiring digital skills.** For example, policies can target workers that have been displaced from their jobs due to automation; workers in new forms of work where there are fewer training opportunities (e.g. part-time workers, temporary help workers, contract workers, free-lancers or self-employed workers); workers in small and medium-size enterprises; or workers with certain demographic characteristics such as women, the elderly or immigrants.

New work relations – adapting structures to tomorrow's realities

Digitalization and globalization, together with changes in labour market institutions, regulations and policies, are **drastically changing work relations.** This has resulted in a reduced need for static hierarchies, fixed desks, and long-term contracts. These are being replaced by flat management and temporary cross-functional teams, virtual workplaces, and shorter contracts.

These changes pose several important challenges to how workers, employers, intermediaries, and other actors on the labour market interact, and we focus on two challenges that seem particularly relevant:

- (i) Digitalisation, worker wellbeing and work-life balance
- (ii) Investing in inclusive technologies.

Digitalisation, worker wellbeing and work-life balance

Non-wage job characteristics, such as **autonomy, trust, and work stress,** have been shown to matter greatly for **work satisfaction,** which in turn matters for **job retention.** For one,

automation has eliminated the need for human intervention in many dangerous and tedious tasks, relieving workers of these tasks. Indeed, there is evidence suggesting the implementation of digital technologies, including Artificial Intelligence, **increases job satisfaction** in many jobs.

However, workers interacting with new technologies also report **higher levels of stress**. This is arguably the case because as routine work is automated, there is more room for creative and problem-solving tasks – and these complex tasks typically bring **higher mental loads**. At the same time, many so-called **last-mile jobs** which emerge as a result of partial automation processes are not stressful because of an abundance of challenging tasks – rather, they are anecdotally known to lack autonomy and may be emotionally stressful in some cases. For instance, warehouse order fillers have documented how their work pace is determined and monitored by technology; whereas human content taggers are being exposed to emotionally taxing material.

The emergence of **new work forms**, including **online platform-based work**, has also spurred some discussion about decent work. On the one hand, many workers who are independent contractors or freelancers value the flexibility and independence that comes with being their own boss and report they prefer working for themselves to being an employee. On the other hand, these contracts sometimes fall outside of standard regulatory frameworks.

Workers, employers and policymakers play a key role in determining the trade-offs for **worker physical and mental health and overall wellbeing** from new workplace technologies. Policies should help **build worker wellbeing into company culture**. Examples are offering preventative medical check-ups (e.g. to prevent “tech-neck injuries”) and training staff to recognize and address stress in colleagues (due to “organization change fatigue” and “learned helplessness” from workplace digitalisation). A focus on **mental health issues** seems particularly important because, unlike many physical conditions, mental health conditions can be denied for a long time by the individual both to themselves and to those around them.

These policies can be based on recent experiences with **Employee Assistance Programs** (EAPs) offered to help employees navigate challenges at work and in their personal lives. Many employees can access early support related to topics like marital challenges, anxiety, and stress – thus providing an early-stage prevention approach that has proven to be cost effective for employers. Aside from improving morale within firms, studies show that through investments in EAPs companies can increase worker productivity and reduce absenteeism costs.

In sum, **occupational safety and health risks are rising in part because of digitalisation**. Although more evidence is needed to determine the emerging trade-offs for worker health and wellbeing from new workplace technologies, policies should focus on **prevention** through EAP-type programs and improve uptake by increasing social acceptance through informed discourse and the delivery of personalized, cost-effective solutions enabled by technology.

Investing in inclusive technologies

The adoption of new technologies at the workplace can have important consequences for workers because the **technological design itself is not neutral to new work relations**. In this, several challenges arise for policymakers.

Artificial Intelligence in the workplace

The use of Artificial Intelligence (AI) technologies in the workplace can lead to problems of **control and surveillance**, especially when AI assesses workers' performance based on data collected from those workers. For example, the **fairness** consequences of the rising use of **algorithmic prediction** for screening and evaluation purposes is an area of active research. Standard machine learning has been shown to acquire **stereotyped biases** from textual data, propagating cultural stereotypes to artificial intelligence technologies that are already in widespread use. One example are online job advertisements where an otherwise identical worker's gender is changed to female instead of male, resulting in fewer instances of ads related to high-paying jobs because training data learn that women are less likely to apply to these jobs.

Further, bias may arise from other causes than biased training data, leading particular worker groups to be disadvantaged. For example, evidence exist that advertising STEM jobs on popular social media platforms leads to the exclusion of women because women are less likely to be shown these ads. However, this lower exposure to STEM job ads is not because women are less qualified or less likely to apply. Instead, young women are a particularly valuable demographic on popular social media, making it more expensive to show them ads. This suggests that **algorithmic transparency is not** sufficient to address all types of bias – policies also have to understand the underlying economic and social mechanisms leading to discriminatory outcomes.

Ideally, policies should also judge algorithmic applications relative to the counterfactual of human judgment, which itself is far from unbiased. For example, human recruitment often focuses on people already in one's network. But since these networks have been shown to be homogeneous in terms of gender and ethnicity, they can generate more male or white applicants in jobs that are already dominated by males or whites. Where they exist, comparisons between machine and human judgement suggest machines may be less biased than humans.

Finally, policies should draw from the emerging field aimed at **auditing algorithms for bias** (also known as "AI neuroscience" because it aims to understand AI decisions). Auditing algorithms are intended to deal with AI's weakness of being a black box in terms of decision-making: without such auditing there is no way to know what caused the bias. The aim of AI auditing is to increase transparency by highlighting which groups are (dis)advantaged by the algorithm. For example, policies could require that companies that use AI to recruit job applicants regularly audit their algorithm. However, the case of STEM job ads on popular social media above shows that such audits aimed at algorithmic transparency may not always be sufficient.

Co-creation of high-quality data

Digital technologies have the potential to improve outcomes for workers and employers. Workers gain because new technologies increase their productivity. Employers gain because data are becoming more economically valuable with the rise of AI leading to increasing returns to scale in the use of data (although some question whether there actually are increasing returns to scale in the use of data). However, **these gains from digitization are not fully realized today because much digital data are of relatively low quality.** For example, workers giving online feedback about their workplace might have little incentives to do so completely or even honestly. An important policy question therefore is **how workers and employers can be incentivized to jointly invest in the creation of high-quality data.**

Incentivizing workers and employers to jointly invest in high-quality data can be done in different ways. For example, regulation can make it easier for employers to monitor workers' performance. At the same time, regulation can stipulate that there must be **shared control** with workers over **key digital assets** such as data but also, for example, code or the design of an online platform that the company owns. This seems particularly true when workers' data include sensitive information, for example related to their physical or mental health. In sum, regulation could help digital technologies to be more easily adopted by workers and employers and, ultimately, to be productive for both through the co-creation of high-quality data.

As a starting point, policies could be based on current EU legislation, including the **General Data Protection Regulation (GDPR)**. However, the GDPR in its current form also seems insufficient in many respects. For example, the GDPR stipulates that personal data can be used by companies if there is an explicit agreement from the person to do so. However, it is unlikely that this would leave much choice to an online platform worker when this explicit agreement is a part of a contract allowing the workers to use the platform.

Finally, it is important to realise that the policies above are aimed at creating incentives for workers and employers to jointly invest in and benefit from the creation of high-quality data. These policies therefore differ from the question of how to value data and how do redistribute this value fairly between workers and employers. However, such actions are beyond the scope of today's policy instruments (e.g. we don't know enough about what could work and why), although there exists some interest in them.

A new social contract – upgrading the European social model

Though digitalization, globalization, and the rising diversity of work forms have generally been sources of economic growth, they also pose challenges for making sure **these gains are fairly shared among all citizens in society**. This section discusses three pathways for building a prosperous and inclusive society:

- (i) Neutral and transferable social security
- (ii) Reducing inequalities
- (iii) Reinvigorating the social dialogue

It is important to note that some of the policies discussed in this section would require **longer to be implemented** (i.e. are not “quick-wins”). In part this is because they would require fundamental changes to the process of policymaking itself, with many different stakeholders possibly affected.

Neutral and transferable social security

In part due to digitalisation, **new forms of work** such as self-employment and gig work are emerging rapidly. However, it is also **unlikely** that they will replace all traditional work relationships. That is, diverse work forms will **co-exist** in the future. The challenge for policymakers therefore is to ensure that a diversity of work relationships can exist while workers can easily move between them.

Social protection in case of unemployment, sickness, accident, old age, becoming a parent, and other life circumstances is a **fundamental part of Europe's social model**. Protection is

provided through means such as social insurance and social assistance, with the details of these schemes varying between countries.

However, **these schemes generally tend to assume that a person is either in traditional employment or is unemployed**. As a result, people engaged in new work forms tend to contribute less to and benefit less from social protection. To the extent possible, this suggests that **social insurance should be neutral to the type of work arrangement**. This could involve portable duties and rights between different work forms.

Even if social security were made more neutral to the type of work contract, several **administrative hurdles** for people engaged in new work forms remain. For instance, registering as a taxpayer, filing taxes, and getting an insurance is often much more complicated for workers in new work forms than it is for employees. Self-employed workers are sometimes treated as firms, even though they lack the dedicated administrative resources and know-how of a firm. People engaged in new work forms find it more difficult to obtain a mortgage, as they are unable to present standard salary slips.

Reducing inequalities

The rise in the skill premium

One of the key features of the digital age has been a tendency towards **increasing labour market inequality** in many countries – albeit from different initial levels. For example, wage dispersion has generally increased. The **main driver behind this increasing dispersion in wage earnings has been technological progress** (along with globalization): new technologies have strongly increased the demand for high-skilled workers more than of less-skilled workers, resulting in an increase in the skill premium. One policy option to reduce the skill premium and, therefore, wage inequality is investing in digital skills (as was discussed above).

The decline in the labour share

There have also been **changes in the distribution of earnings between capital and labour**: in particular, **labour's share of national income has decreased in many countries**. This trend appears to be partially driven by advancing technologies. It goes without saying that capital income is also owned by people, and therefore the declining labour share does not reflect a decrease in incomes – however, capital income is much more unevenly distributed across citizens than labour earnings, reinforcing the trend towards more income inequality.

If the view is that the declining labour share results from efficient-but-unfair market processes, the policy solution is to let the market do its job and then use **redistributive taxation and transfers** to share the gains of economic prosperity more equitably. However, **current tax policies are doing the opposite by favouring capital income and capital investments over job creation**. When a firm hires a machine instead of a worker, it receives tax breaks, amortized allowances and various tax credits, while employing workers comes with additional payroll taxes and fringe benefits.

Job polarization

Over the last decades, many advanced countries have also seen a process known as **job polarization**. This means that there has been a decline in employment shares of jobs in the

middle of the wage distribution, such as clerical and production work, while employment shares of high-skilled professional jobs have increased. Employment shares of low-skilled jobs (such as construction labourers, childcare workers, waiters, and a range of personal care and service workers) have also risen, albeit to a lesser extent.

Job polarization arises because many of the tasks performed by medium-skilled workers can be automated using digital technologies. High-skilled workers, on the other hand, have been made more productive by these technologies, but without being replaced: these technologies complement their tasks. At the same time, many tasks that do not require high levels of human skill (e.g. cleaning or hairdressing) remain very difficult or not economically convenient to automate. This is why low-skilled work has not declined in the same way as middle-skilled work.

Job polarization also has an important regional component. In the 1970s, denser (i.e. more urban) regions had far more middle-skill work than did suburban and rural regions. But this feature attenuated and subsequently reversed sign over the next four decades. That is, while middle-skill work was differentially present in urban areas in the 1970s, it was differentially absent from those same places 45 years later, in addition to less prevalent everywhere in absolute terms. That is, **jobs in suburban and rural areas are disappearing all together, while employment in urban areas is growing but characterised by job polarization.**

In urban areas, policies should protect the increasing number of workers in precarious jobs. For example, this could be done by introducing a **minimum living wage in urban areas**. Alternatively, income security for low-wage workers can be organized through **welfare-to-work programs** that reduce the risk of poverty while incentivising individuals to do paid work, such as the Earned Income Tax Credit (EITC) in the U.S. or the New Deal in the U.K. Many Continental European countries have followed these programmes in different formats and with varying scope since the mid-1990s, but considerable room remains for further improvements and increases in scope.

In the most promising suburban and rural areas, policies can target **investments (including high-tech investment) for regional gentrification in the longer-run**. In the least promising suburban and rural areas, policies can facilitate **emigration opportunities** for the most promising workers to move to urban areas elsewhere, while preserving living conditions for those that are forced to stay behind.

Reinvigorating the social dialogue

No society has achieved shared prosperity by just redistributing income from the rich to the less fortunate. Rather, **shared prosperity** typically results from the ability of institutions to forge “**inclusive markets**” that devise a level playing field for people and provide the conditions for broadly shared growth.

One way to create inclusive markets is through a **social dialogue** and the **labour institutions** that result from it. For example, union wage bargaining, though often blamed for choking off employment and entrepreneurship, can be vital for encouraging the creation of good jobs. Without a floor under wages, firms might find it beneficial to forgo new technologies and productivity-enhancing activities, instead opting to pay **very low wages to low-productivity workers**. Wage pressure from effective bargaining can therefore induce firms to invest in workers and new technologies, and to create high-wage jobs.

Before the 1980s, the European social dialogue, underpinned by democratic politics, promoted the creation of high-wage jobs and provided a social safety net, protections for workers, and government-funded education. However, the power of these institutions started to weaken, just as digitalization and globalization gained momentum in the 1980s.

One example is the role of labour unions. In most advanced economies, labour unions were at their peaks in the 1950s, 1960s and 1970s. However, **union activity has generally declined since 1980s**. One reason for this decline is the process of employment de-industrialization, and the difficulties of trade unions to organize workers in new establishments in particular. The gig economy has also emerged as a small but mostly non-unionized sector, despite significant efforts and some successes by unions to organize gig economy workers. Structural changes in labour markets are thus challenging the social dialogue in many advanced economies.

Therefore, social partners should (and in many cases have already started to) **review and revise their organizational models and participatory processes in line with what is possible and necessary in today's environment**. Shared prosperity requires revitalized labour market institutions should stimulate investments in digital skills; policies to protect worker health and wellbeing; investments in inclusive technologies; neutral and transferable social security; equality in wage earnings; and equality of job opportunities across and within regions.