

## OCCUPATIONAL SAFETY AND HEALTH RISKS OF REMOTE PROGRAMMING WORK ORGANISED THROUGH DIGITAL LABOUR PLATFORMS

### Introduction

This case study examines remote programming provided through digital labour platforms. It explores the occupational safety and health (OSH) risks this type of work presents to platform workers, as well as whether and how such risks are prevented and managed, highlighting practices and actions introduced by platforms. For the purposes of this case study, digital platform work is defined as all paid labour that is provided through, on or mediated by digital labour platforms, which connect platform workers with clients, with the aim of carrying out specific tasks or solving specific issues. The main characteristics of platform work include the **use of algorithmic management** to allocate, monitor and evaluate the work performed and the behaviour and performance of the platform workers, **triangular work relationships**, and a **prevalence of non-standard working arrangements**. This case study is part of a project on platform work and OSH, which aims at providing an overview of OSH policies, research and practices in the context of digital platform work through the review of the literature and available data and fieldwork (EU-OSHA, 2021b).

Methodologically, the case study is based on a thorough review of recent academic and grey literature (including resources published on Eurofound's platform economy repository), focusing in particular on literature covering remote programming specifically and, more generally, higher-skilled online platform work. Besides a literature review, the case study builds on three interviews with platform workers and two interviews with platforms. Where possible and relevant, comparisons are made with similar work activities executed outside of the platform economy.

### Remote programming

Programming tasks are defined here as the process of writing and testing code that allows computer applications and programmes to function properly (US Bureau of Labor Statistics, 2021).<sup>1</sup> Additionally, programmers may expand the code of existing programmes or test programmes for errors, finding and resolving faulty lines of code to ensure that everything is running smoothly, using a multitude of computer languages to develop, test and fix programs (such as C++, Java or Python). Programmers may use their expertise to develop websites to ensure the overall look and functionality of the site is up to the standards necessary, as well as oversee design and technical elements (for example, how much traffic the site can handle) (Stokdyk, 2021). The definition of 'computer programming' used in the European Skills, Competences, Qualifications and Occupations (ESCO)<sup>2</sup> is in line with the above definition. In ESCO, individuals carrying out programming tasks are categorised as 'professionals', and as 'information and communication technology professionals' more specifically, which includes professions such as web and multimedia developers, software developers and applications programmers. In general, programming involves desk-based work and heavy computer use, which may create health and safety issues, as elaborated below.

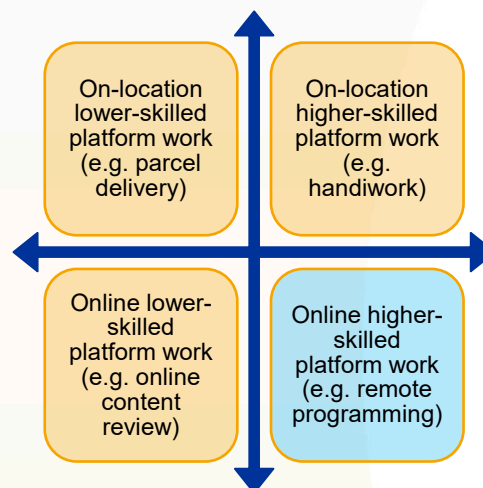
Programming work can be done either in-house (for example, an internal IT department) or outsourced. Already today, the IT outsourcing market represents a significant part of the service outsourcing industry. In the US, for example, the market size of ICT outsourcing amounted to 66.52 billion U.S. dollars in 2019 (Statista Research Department, 2020).<sup>3</sup> Business models based on outsourcing work allow for more flexibility to adjust the workforce to changing conditions, and hence reduce the risks for

<sup>1</sup> See: <https://www.snhu.edu/about-us/newsroom/stem/what-do-programmers-do>;  
<https://www.computerscience.org/careers/computer-programmer/>

<sup>2</sup> For more information, see: <https://ec.europa.eu/esco/portal>.

<sup>3</sup> Available at: <https://www.statista.com/statistics/190122/total-gloabl-contract-value-information-technology-outsourcing/>

the company outsourcing work, as well as broaden access to a wider pool of skilled workers and lower (labour) costs (OECD, 2018). If a programming task is outsourced, programmers can be working either as an employee in a company contracted by the client or instead carry out these tasks as an independent contractor (directly for the client or through a third party). As elaborated below, the latter case is applicable in the context of platform work, with platforms bringing into contact clients with software development requests and IT professionals who offer this expertise and who carry out this work on a task-by-task basis. In that sense, the platform can be viewed as a new outsourcing institution, enabled by digital technology (Vandaele, 2018; Lehdonvirta et al. 2019; Bérastégui, 2021). Corresponding to the taxonomy laid out in the EU-OSHA (2021b) study, remote programming is then a form of **higher-skilled online platform work**.



Looking at the categorisation from the COLLEEM II survey, remote programming can be classified as 'online software development and technology work'. It appears that software development is the most male-dominated task (next to transport). Additionally, there seems to be a great proportion of highly educated platform workers carrying out these types of tasks. Overall, this type of platform work is quite common and found on large, international platforms such as Freelancer.com, Upwork or Fiverr, on which remote programmers often constitute a global workforce, in which companies can access thousands of workers simultaneously and 24/7 (Digital Future Society, 2020). Nonetheless, there are also local platforms on which these types of services are offered (such as creme de la creme (FR) and Worksome (DK)).

**The COVID-19 pandemic** has severely impacted platform work (ETUI, 2020; Eurofound, 2020 & 2021; Rani and Dhir, 2020). However, this impact differs greatly across different types of platform work (OECD, 2020; Eurofound, 2021). As for **online platform work**, some types saw an increasing demand (for example, IT support and translation services), while other types witnessed a decline (for example, data entry, clerical tasks and sales and marketing support) (Eurofound, 2021). The Online Labour Index demonstrates that there was a significant increase in both labour demand and labour supply of 'software development and technology', with businesses continuing their outsourcing (Stephany et al., 2020; Rani et al., 2020). Additionally, the number of individuals creating a profile on these platforms have skyrocketed (Stephany et al., 2020). This may be partly explained by the loss of income from other sources (OECD, 2020). At the same time, the pandemic prompted many workers in the traditional labour market to work from home. This led to increased attention on the implications of such working arrangements from national governments and academics, including in relation to OSH

## Work-related safety and health aspects of remote programming

Remote programmers are exposed to **physical and psychological health and safety risks** when performing their work (Royer, 2021; Tubaro and Casilli, 2021). To gain further insight into these OSH risks, as well as how OSH risks can be prevented and managed, this section will first describe the OSH risks that directly follow from the tasks performed by programmers (such as desk-based work and heavy computer use), and then show why and how these risks may be increased in the case of programming through digital labour platforms.

## OSH challenges and risks related to work activities

Programming tasks performed as digital platform work are **highly similar to those carried out in the traditional labour market** (such as in-house programmers), outside of the fact that when organised through digital labour platforms, it requires **extra tasks** (such as account management, obtaining work digitally and communicating with clients) which are not necessarily required in other settings (see Huws, 2015; Huws et al., 2017; Tran and Sokas, 2017; EU-OSHA, 2017; Samant, 2019; European Parliament, 2020; European Commission, 2020).

From an OSH perspective, the **physical risks** of programming correspond to the risks identified in the context of desk-based work activities and heavy computer use. Ergonomic issues, due to inappropriate setting of the workstation, including the visual display unit, keyboard, desk and chair, may lead to the

development of musculoskeletal disorders (MSDs), in particular those of the upper limbs, neck and back, as well as eyestrain from the visual display unit work (Eurofound, 2020; EU-OSHA, 2021a; EU-OSHA, 2021b). In addition, prolonged sitting and sedentary behaviour may have a negative impact on workers' health; it is a known factor in health effects such as low-back pain, neck and shoulder complaints, Type 2 diabetes, cardiovascular disease and obesity (EU-OSHA, 2018; Eurofound, 2020; EU-OSHA, 2021a; EU-OSHA, 2021b, ILO, 2021). At the same time, these physical risks may additionally have a negative psychological impact. For instance, evidence has shown how excessive screen time increases depressive symptoms and Internet addiction (EU-OSHA, 2018; Twenge et al., 2018; Bérastégui, 2021). Other **psychological risks** that programmers face relate to issues such as isolation and excessive workload, which can have an impact on workers' well-being (Buomprisco et al., 2021; Daenen, et al., 2021). One platform interviewed for this case study corroborated these findings, by highlighting that isolation and overworking are two key issues in their estimation, especially for platform workers with less experience.

## Factors aggravating OSH challenges and risks in platform work and/or complicating the management of those risks

Even though the risks and hazards of remote programming in the context of digital platform work are largely similar to those in the traditional labour market, the specific characteristics of digital platform work aggravate these challenges and complicate the implementation of a sound health and safety policy. Several dimensions will be considered here: a) employment status and contractual arrangements; b) algorithmic management and digital surveillance; c) professional isolation; d) work-life balance and job/income insecurity.

## Employment status and contractual arrangements

The employment status establishes the roles and responsibilities of the different actors in relation to health and safety in many Member States. In accordance with Directive 89/391, the employer is responsible for the development of physical and psychosocial risk assessments and management which forms an essential part of identifying and mitigating possible health and safety risks to workers, including those working in the digital platform economy (European Parliament, 2021). However, from the available data it appears that most digital platform workers performing online tasks, including remote programming, are classified as self-employed or 'occasional' workers. As is the case for most platform workers, contracting is done online, with platforms unilaterally imposing the terms and conditions, and often without any personal contact between the parties (European Parliament, 2020). For instance, one platform interviewed for this case study stated that all platform workers who start work through their platform are required to be registered as self-employed and also have to upload the documentation supporting this onto the platform. An automatic check is then carried out with the relevant administrations in the country to determine whether the documentation is correct. If the check fails, the platform worker is simply not allowed to access the platform.

The self-employed status implies that the workers themselves bear the costs, risks and responsibilities related to labour protection, social security and taxation in most Member States (Prassl, 2018a, b; Arshf and Etcovitch, 2018; Royer, 2021), including in the area of OSH (EU-OSHA, 2017; Tran and Sokas, 2017).

A classification as employee is less straightforward in comparison with more known types of platform work such as food-delivery or passenger transportation workers, and even online microworkers (such as content moderators). Indeed, remote programmers in the digital platform economy are characterised by a large degree of autonomy and flexibility in determining how, when and how much they work. In most cases, they are also able to set their own prices without interference from the platform. One platform interviewed mentioned explicitly that platform workers do not face punishment for rejecting tasks and that they have complete autonomy in setting their prices and managing their time. In that respect, Leimeister et al. (2016) describe how tasks requiring specialised skills performed online, for instance programming, inevitably warrant a reasonable degree of autonomy in work organisation for the platform worker (European Commission, 2020). However, it must be mentioned that differences exist between the platforms in the degree of managerial power exercised (such as the matching process, price-setting, work evaluation, and so on). For example, one platform interviewed stressed that, in principle, the platform does not interfere in the selection process of tasks and work organisation, which is run in complete autonomy by the client and the platform worker. However, a second process



is also possible on this platform, by which the platform itself selects (through human intervention, not algorithmic) possible candidates for the task.

**Platform worker:**

*'The platforms leave you very independent, the only thing they interfere with is the payment. For Fiverr and Upwork the process is different. Fiverr, at the end of the project, withholds 20% for its service, and then pays the remaining amount to the programmer. However, on Fiverr, the programmer receives the payment only if the client is fully satisfied with the entire project. In contrast, Upwork is a bit different because it allows you to approve steps one at a time. So, once the programmer and the client have approved a step there is no chance of that step not being paid for'.*

Although the literature suggests that digital platform workers performing high-skilled tasks tend to be more aware of potential OSH risks and are more likely to take necessary measures to prevent OSH injuries (EU-OSHA, 2017; Eurofound 2018; Eurofound, 2019), it still seems that only limited information and support is provided by the platform regarding occupational health and safety standards.<sup>4</sup> Both platforms interviewed for this case study corroborated this finding. No comprehensive policies regarding OSH (that is, risk assessment, protective and preventive measures, training, consultation and information) have been identified, although one platform representative interviewed mentioned that they are actively engaged in promoting the mental health of the platform workers, through newsletters and blog posts.<sup>5</sup> These observations were also echoed repeatedly by the platform workers interviewed for this case study:

**Platform worker:**

*'The platform does not provide any kind of procedure or guidelines, there is no contract, documentation, or anything else. They just turn over the money, but they don't send any kind of instruction'.*

**Platform worker:**

*'When I registered to the platform, I did not receive any documentation, procedures or guidelines on health and safety. The platform did not contact me, and I have never experienced a personal contact with an employee from the platform itself. [...] The platform did not provide me with training on how to use devices or tools'.*

As a final point, it must be highlighted that the global nature of programming on digital platforms complicates things even further. Platforms offering these types of tasks usually operate on a global basis, raising challenges regarding the applicability of the EU legal framework, including OSH. At the same time, the client requesting tasks may also be based outside the EU, adding another layer to difficulties regarding the applicability and enforcement of relevant rules.

## Algorithmic management and digital surveillance

Möhlmann and Zalmanson (2017) define algorithmic management as the **oversight, governance and control practices conducted by software algorithms over many remote workers**. Digital platforms intermediating lower-skilled on-location and lower-skilled online platform work, especially, tend to deploy a high level of control through algorithmic management and (semi-)automated decision making (European Parliament, 2020). Although these practices are less pronounced in the context of remote programming (as a form of higher-skilled online platform work), issues may still arise (European Commission, 2020). For example, Upwork can check whether a platform worker is active during an hourly-paid job, as the platform takes screenshots of the platform worker's computer, checks the keystrokes and records work completed (Prassl, 2018a; Prassl, 2018b; Bérastégui, 2021).

<sup>4</sup> Nonetheless, for example on Upwork's website, several articles are available related to OSH, such as tips to reduce stress and improve the ergonomics of the working station. Available at: <https://www.upwork.com/resources/work-from-home-tips-staying-sane-productive-stressful-times>; <https://www.upwork.com/resources/work-from-home-ergonomics-tips>

<sup>5</sup> For instance: <https://weworkremotely.com/work-from-home-burnout-the-6-month-slump>

Algorithmic management also involves the use of rating mechanisms for (future) task allocation, (European Commission, 2020; European Parliament, 2020). These practices are particularly prevalent for digital platforms intermediating remote programming. Urzi Brancati et al. (2020) have compared working conditions of ten types of platform work, including 'online software development'. The results of the survey demonstrate that 'online software development' records the second-highest share of platform workers stating that ratings are very important for getting work. For instance, on Fiverr, once a task is completed, the client has the option of writing a review and rating the quality of the completed task. Based on the workers' activity and reputation, Fiverr then assigns a 'level' to each worker (for example, New, Level 1, Level 2, Top Rated) with higher level platform workers able to receive more tasks and price their tasks higher (Huang et al., 2019). Also, on the Malt platform, for every task completed, the platform worker receives a rating from the client. Interestingly, platform workers active on this platform also have the option to rate clients, which can lead to the removal of the clients from the platform.

From an OSH-perspective, this dependence on good ratings for future work opportunities causes stress, which is even more true for higher-skilled online platform workers where the work is more loosely defined and expectations are not as clear-cut (Schmidt, 2017; Ropponen et al., 2019; European Commission, 2020). Despite the lack of direct and physical contact with clients (see below), evidence suggests that these types of platform workers do in many cases invest extra effort and thought into building lasting relationships with clients (Sutherland et al., 2019; Bérastégui, 2021). All in all, it requires platform workers to have a service-based mentality and be ready to answer any request from the client, making it much more emotionally demanding than their counterparts in the traditional labour market (such as remote programmers working as full-time employees for a company) (Lee et al., 2015; Rosenblat and Stark, 2016; EU-OSHA, 2017).<sup>6</sup> One platform worker mentioned how part of his 'score' depends on the speed of his response to the clients, leading to an intensification of work and speed pressure which is not comparable to this type of work outside the platform economy. In turn, this may lead to increased levels of psychological risks (EU-OSHA, 2021b).

**Platform worker:**

*'There is a rating system, so you can rate both the client and the platform worker. However, I do not like the system because if you do not have a good rating it is difficult to be hired again. Even worse if you have only one review and the review is bad it will be complicated to be selected by a new client.'*

## Professional isolation

All types of platform work are characterised by an individualisation of work and work-related physical and social isolation, also known as 'professional isolation' (Bérastégui, 2021). Existing evidence shows that professional isolation is a large determinant in terms of psychosocial risks, leaving little or no room for emotional support (Ropponen et al., 2019). The literature has indicated how dehumanisation of work and relationships makes jobs less satisfying as the human/social aspects are lost and tasks become less varied (EU-OSHA, 2018). Additionally, the lack of face-to-face communication and an overall lack of social contact has the potential to lead to less well-developed social skills (EU-OSHA, 2018).

All these aspects become even more pressing in the context of online platform work, including platform-based remote programming, which is usually carried out at home ('physical isolation') with little or no physical contact with the platform, the client or other platform workers ('social isolation'), as the entire process of contracting, executing and delivery of tasks is done online, mostly through algorithmic practices (Graham et al., 2017; European Commission, 2020; ETUI, 2021). One platform interviewed did mention that they regularly organise events for their online freelancers, allowing them to interact with each other every month. Another platform interviewed mentioned explicitly that there is not a proactive approach from their side to enter into communication with the platform worker.

<sup>6</sup> Additionally, a study on Fiverr showed that the rating mechanisms often have a significant statistical relationship with perceived gender and race (Hannák et al., 2017).

**Platform worker:**

*'A disadvantage of platform work is the almost total absence of physical connection, which you start to feel after a while. Also, when there is something unclear, you have to be careful to mark everything well, keep track, and at the call afterwards remember to unravel the problems that have occurred. The speed with which you can solve the problem physically [...] is unreplaceable'.*

**Platform worker:**

*'Another drawback is the lack of trust between client and programmer. When you, as a young programmer, present yourself to the 'old fashioned' entrepreneur through the platform, without having a human/physical contact, he will find it more difficult to trust you and [...] give you access to many of the software and databases with confidential information. This lack of physical connection can complicate or slow down the work of the programmer for this reason'.*

Additionally, as a form of remote e-working<sup>7</sup>, this type of work is carried out outside the context of a **shared and formalised workplace** (such as the employer's premises or even the client's premises), usually carried out at home using a computer and Internet connection. The available literature has identified both advantages and disadvantages for this type of working arrangement (Eurofound, 2020; EU-OSHA, 2021a; European Parliament, 2021). On the one hand, it can have positive effects for workers, who reported greater autonomy, better work-life balance, higher productivity and reduced commuting times (Charalampous, et al., 2019; Eurofound, 2020). Similar statements were echoed by interviews conducted with platform workers performing remote programming for this study.

**Platform worker:**

*'The main advantage of working through a platform is that you can arrange your schedule in order to follow as many clients as it suits to you. While doing this you know that you will not lose time by going from an office to another. You can save a lot of time[...]'.*

**Platform worker:**

*'When Covid-19 broke out I was a "digital nomad". Thanks to platform work I was able to travel to Italy and Spain (when this was allowed), and I have worked on the mountains or by the seaside. I think that this has increased my productivity, because I was working from beautiful places, without being obliged to sit in an office'.*

On the other hand, there may also be disadvantages. Indeed, despite the autonomy and flexibility offered, remote workers may experience increased work intensity and longer working hours, which are likely to affect the stress levels of the worker (Eurofound, 2020). For instance, while reduced commuting times are seen as an advantage, it could also make it more difficult for workers to transition from private to work life, which could also have a negative impact on mental well-being (EU-OSHA, 2018). These issues will be further explored below. Additionally, because these activities are executed in unconventional workplaces (including from home), workplaces and work equipment (such as a desk, laptop and keyboard) are often not adapted to the needs of platform workers (Huws, 2015; EU-OSHA, 2017; EU-OSHA, 2021a; EU-OSHA, 2021b).

## Work-life balance and job/income insecurity

As already referenced above, working from home may create a heightened risk of work-life conflicts for remote programmers, which is associated with sleep problems, stress, burnout and an overall dissatisfaction with one's job and personal life (Halford, 2005; Taskin, 2007; Bérastégui, 2021). This is especially true when the perceived autonomy leads to heightened work intensity, if combined with heavy workloads, competition and increased self-management (autonomy paradox) (Ropponen, et al., 2019; Eurofound, 2020). This may be even more evident in the context of remote programming as a form of higher-skilled online work, especially for those who rely on platform work as a major source of income. One platform worker interviewed mentioned how this type of work can lead to

<sup>7</sup> Remote e-working is defined as 'work being completed anywhere and at any time regardless of location and to the widening use of technology to aid flexible working practices'. See: <https://oshwiki.eu/wiki/Telework>

'insane' habits, referring to the possibility of being contacted at any moment of the day. This need to be available 24/7 could lead to stress, which is even more likely when platform workers need to interact with people in different time zones, creating a need to work at unsociable times of the day (EU-OSHA, 2018). On the other hand, one platform worker interviewed mentioned that because of his particularly high remuneration per task, it allowed him to maintain a better work-life balance.

For instance, Urzi Brancati et al. (2020) report that online software development is among the types of platform work for which the incidence of longer hours is the highest. Moreover, to a large degree this type of platform work tends to take place outside typical (9 to 5) working hours (Urzi Brancati et al., 2020). In addition, the self-employed status of this type of platform workers effectively means that they are not covered by the protective provisions of the Working Time Directive, thereby increasing the risk of work-life conflicts (Bérestégui, 2021). This observation is confirmed by a recent study of Wood et al. (2019), where freelancers providing online platform work highlighted that they had to work intense and irregular hours to meet the clients' expectations and maintain an adequate income.

**Platform worker:**

*'I have several colleagues who do this job, through the platform, and they receive requests at absurd hours, 24/7, this can cause stress'.*

Finally, platform work is often associated with (chronic) job insecurity and income insecurity, which has been linked with poorer mental health, burnout, depression, anxiety, but also physical health issues such as fatigue and pain (Cottini and Lucifora, 2013; Huws, 2015; Mattila-Wiro, 2020; Bérestégui, 2021; ILO, 2021). In general, remote programmers are allowed to set their own prices more frequently, in comparison with low-skilled on-location and online work, resulting in a higher remuneration per task. The results from Urzi Brancati et al. (2020) demonstrate that for 'software development', payment is the highest per task and per hour, in comparison with the other nine types of platform work covered. Most macrotask platforms charge the worker a fee, typically ranging from 5% to 20% of the project cost (Berg et al., 2019). Nonetheless, although professional online workers generally feel that they receive fair remuneration for their work, the income earned remains unpredictable (Pesole et al., 2018; Eurofound, 2018; European Commission, 2020). The highly competitive environment in which remote programmers are often competing in a global pool of other platform workers in order to be selected by the client, can result in situations where task assignments and the number of tasks one can carry out is continually unpredictable, especially for platform workers new to the platform (Ropponen et al., 2019; European Parliament, 2020, European Commission, 2020). Indeed, one of the main concerns of online platform workers in general is having insufficient work (Berg et al., 2018; European Parliament, 2020). In order to limit competition which could drive down prices, one platform interviewed limits the number of online freelancers who can see a particular task.

In addition, platform workers may be faced with the rejection of the task by the client, with limited opportunities for recourse (Berg et al., 2019). One platform worker highlighted that he is carrying out his work under constant pressure, wondering each time if his work will be paid or not depending on whether the client is satisfied with his performance. Moreover, platform workers may spend unpaid time waiting for work to be assigned (which is strongly linked to job insecurity) (Ropponen et al., 2019; Berg et al., 2018; Urzi Brancati et al., 2020). For instance, on most platforms the final price for their work is set via a negotiation process with the client, which can take a considerable amount of time (Berg et al., 2019). One platform worker interviewed complained explicitly about the very slow process of selection, which can take up to a week in some cases. That same sentiment was echoed by another platform worker, who complained that the selection usually takes a very long time, especially concerning the negotiation of the price with the client.

**Platform worker:**

*'There is a lot of competition between programmers when it comes to proposing jobs and being selected. The consequence of this is that when you have to get the first jobs you try to get as many as you can to move up in the rankings. That could also imply overworking'.*



*'When you put on your request, you start receiving proposals from clients that could need your services. It can take quite a long time before obtaining a job. The wait depends on several factors, the client can negotiate the price, or they can take a lot of time to decide if they want to let you do the task or another programmer'.*

## Conclusions

Individuals carrying out programming tasks are categorised as 'professionals', and as 'information and communication technology professionals' more specifically, which includes professions such as web and multimedia developers, software developers and applications programmers. Remote programmers working through digital labour platforms face similar risks regarding OSH risks, derived from desk-based work and heavy computer use. Ergonomic issues, due to inappropriate setting of the workstation, including the visual display unit, keyboard, desk and chair, may lead to the development of MSDs, in particular those of the upper limbs, neck and back, as well as eyestrain from the visual display unit work (Eurofound, 2020; EU-OSHA, 2021a; EU-OSHA, 2021b). In addition, a more sedentary lifestyle may increase the risk of poor posture, cardiovascular disease, obesity, stroke and diabetes, and may increase the likelihood of anxiety (EU-OSHA, 2018).

Nonetheless, the specific features of the platform economy have the potential to exacerbate these negative effects. Most digital platform workers performing online tasks, including remote programming, are classified as self-employed or 'occasional' workers, which is also true for programmers outside the platform economy who are in many cases active as freelancers. Unlike other types of platform workers, remote programmers working through digital labour platforms have a large degree of autonomy and flexibility in determining how, when and how much they work. In most cases, they are also able to set their own prices without interference from the platform.

Consequently, the protective provisions of the OSH legislative framework in most Member States do not apply to them. Indeed, the work-related health and safety risks do not seem to be managed by the platforms (nor the clients) in a comprehensive manner, pushing OSH management onto the platform workers. Although the literature observes that digital platform workers performing high-skilled tasks tend to be more aware of potential OSH risks and are more likely to take necessary measures to prevent OSH injuries than lower-skilled platform workers (EU-OSHA, 2017; Eurofound, 2018 & 2019), health and safety issues may still persist as individual workers often lack the knowledge, training or resources to take appropriate measures (OECD, 2018). While some platforms offer basic and patchy guidelines, no examples were found of general OSH policies.

The most distinguishing feature of remote programming through digital labour platforms is the fact that remote programmers have to 'fight' to maintain high ratings in order to be allocated more (rewarding) tasks. This makes this type of work much more emotionally demanding than that of their counterparts in the traditional labour market, especially for younger and less-experienced platform workers. Indeed, despite the fact that the level of algorithmic control through decisions on *work allocation* and *work organisation* is far less intrusive compared to types of low-skilled on-location (such as food delivery) and low-skilled online (such as microwork) platform work, the high reliance on ratings (*work evaluation*) to be selected by the client, results in situations where task assignments and the number of tasks one can and wants to carry out is continually unpredictable (European Parliament, 2020; European Commission, 2020). In addition, this may lead to an intensification of work and speed pressure, which is associated with increased levels of psychological risks (EU-OSHA, 2021b).

Important to highlight is the fact that remote programmers often constitute a global workforce, in which companies can access thousands of workers simultaneously and 24/7 around the world (Digital Future Society, 2020). This raises challenges regarding the applicability of the EU legal framework, including OSH. At the same time, the client requesting tasks may also be based outside the EU, adding another layer of difficulties regarding the applicability and enforcement of relevant rules. Moreover, it creates an environment in which remote programmers compete in a global pool of other platform workers to be selected by the client, which can result in situations where task assignments and the number of tasks one can carry out is continually unpredictable, especially for platform workers who are less experienced and just entered the platform (Ropponen et al., 2019; European Parliament, 2020; European Commission, 2020).



Finally, platform-based remote programming is usually carried out at home ('physical isolation') with little or no physical contact with the platform, the client or other platform workers ('social isolation'), as the entire process of contracting, executing and delivery of tasks is done online, mostly through algorithmic practices (Graham et al., 2017; European Commission, 2020; ETUI, 2021). Existing evidence shows that professional isolation is a large determinant in terms of psychosocial risks, leaving little or no room for emotional support (Ropponen et al., 2019). In addition, remote programmers working in the platform economy may be faced with heightened work-life conflicts. Urzi Brancati et al. (2020) report that 'online software development' are among the types of platform work for which the incidence of longer hours is the highest. Moreover, to a large degree this type of platform work tends to take place outside typical (9 to 5) working hours, which is even more likely when platform workers need to interact with people in different time zones (Urzi Brancati et al., 2020).

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