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Digital transition: an online survey to assess the impacts of technology on workers' health and safety

Transizione digitale: un'indagine online per valutare gli impatti della tecnologia sulla salute e sicurezza dei lavoratori

di

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Abstract:

One of the objectives of the 2030 Agenda is to promote lasting, inclusive and sustainable economic growth in which digital technology is an essential driver to ensure the active participation of the entire population and to support structural and organisational change. With the digital transformation, the paradigms that have previously characterised the world of work are changing, and consequently the

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way in which health and safety at work is managed too. For this reason, an online survey was conducted to assess workers' perceptions of occupational health and safety protection in contexts subject to digital transformation. The areas investigated included work organisation and management, regulatory and protective aspects, and training and skills development. The survey involved 300 participants (63% women and 37% men), equally distributed between the public and private sectors. The study shows that digital training and support to the use of technology are essential measures for the adequate management of new occupational health and safety risks in the digital transition process.

Keywords: digital transition, health and safety at work, occupational skills.

Abstract:

L'Agenda 2030 ha tra i suoi obiettivi la promozione di una crescita economica duratura, inclusiva e sostenibile in cui il digitale rappresenta un driver essenziale per garantire una partecipazione attiva di tutta la popolazione e supportare i cambiamenti strutturali e organizzativi.

Con la trasformazione digitale cambiano dunque i paradigmi che hanno caratterizzato fino ad ora il mondo del lavoro e di conseguenza le modalità di gestione della salute e della sicurezza sul lavoro.

A tal fine è stata realizzata un'indagine online per valutare la percezione dei lavoratori rispetto alla tutela della salute e sicurezza sul lavoro nei contesti soggetti a trasformazione digitale.

Le aree indagate hanno riguardato l'organizzazione e gestione del lavoro, gli aspetti normativi e di tutela e la formazione e lo sviluppo di competenze.

All'indagine hanno partecipato 300 soggetti (63% donne e 37% uomini), equamente distribuiti tra il settore pubblico e quello privato. Dallo studio emerge che la formazione e il supporto rispetto all'uso della tecnologia costituiscono misure essenziali per un'adeguata gestione dei nuovi rischi per la salute e sicurezza sul lavoro nei processi di transizione al digitale.

Parole chiave: transizione digitale, salute e sicurezza sul lavoro, occupational skills.

Introduction

The digital transformation is first and foremost a process of evolution of business models that is necessarily based on advances in technology. It consists, in fact, in a radical change within the corporate culture for the adoption of digital technologies that can improve or replace existing approaches and processes. Digital transformation is therefore not just a product or a solution to be purchased, but an approach that has an impact on the entire organisation of work in public and private environments. In this context, one of the biggest challenges for digital transformation is the retraining of workers who, partly because of the rapid changes, are constantly forced to reinvent themselves, developing and acquiring new skills. Moreover, the lack of specific digital competences, useful to better manage the work-life balance, the frequent changes of job activities, i.e. different occupations during one's professional life and the prolongation of working life due to pension reforms, require the development of an experimental and participative information and training process, also in the perspective of open innovation, which can meet the training needs of new professional figures (Santonastaso, 2022).

Training can therefore represent a possible prevention measure aimed at mitigating risks in contexts of high digital transformation. It is therefore necessary to devise and design training processes in which the continuous training of workers avoids the obsolescence of professional skills due to digital innovation, while taking into account both the ways in which to relate in a 'healthy' way to technologies, and the necessary identification of new risk factors linked to the digital transition. The lifelong learning also plays a central role, as highlighted in the Digital Agenda, presented by the European Commission as one of the seven flagship initiatives of the Europe 2020 strategy, and in the European Pillar of Social Rights. Digital technologies lend themselves particularly well to accompanying a more effective lifelong learning pathway by reducing the time it takes to use the content, making it easier to replicate training interventions on a large scale and reducing the management costs for employers to organise training activities. This study presents the results of an online survey to analyse the impacts of digital transformation on workers' health and safety in the Italian context with a specific focus on digital platforms.

1. The changes in the world of work: new challenges for the occupational safety and health

In order to support a concrete organisational change, which takes into account both workers' well-being and company business, it is important to analyse the impacts of the digital transition on the new work organisation on health and safety at work; in particular technostress, risks associated with new human-machine interfaces, ergonomics and cognitive load, increased pressure in terms of workers' performance due to process automation, cybersecurity risks due to an increase in the interconnection of things and people (Costantino, 2021), ergonomic risks due to the increasing use of technological tools (places outside the office and/or inadequately equipped) (Pietrafesa, 2018).

This new framework totally changes the concept and the very environment of work, the way of working, and the perception of work itself. The 4.0 worker must have a remarkable ability to recover and adapt quickly to change in order to sustain positive change. Today, within corporate contexts, also as a result of the Covid-19 pandemic emergency, this profound transformation is already being experienced in terms of productivity, income, but also from an organisational and technological point of view. According to the International Labour Organisation (ILO), in 2021 there will be 100 million fewer jobs worldwide and 26 million in 2022, while the number of working poor (108 million) is expected to increase (Berg, 2021). Technological innovation will make the difference in terms of job quality and salaries: according to Unioncamere's Excelsior database, the ecological and digital transition sectors will in fact lead the demand for new, highly qualified professional figures. One of the effects of the Covid-19 pandemic, which marked 2020, was to speed up the spread of digital technology in many sectors. The downturn in the digital market was therefore very slight and less than that of the economy as a whole. There was also growth in the digital market's share of GDP in 2020, from 4.0% to 4.3% in 2017-2020. The contribution of digital technologies has been crucial in ensuring the continuity of production activities and in supporting the widespread diffusion of remote working. Especially in the first lockdown, companies started or continued to invest in Virtual Private Networks, collaboration platforms and solutions for remote access to business applications and services. Confirming the increase in digitisation among businesses, including medium and small ones, the number of remote workers rose from 570,000 in 2019 to over 6 million during the first lockdown in March 2020 (+1,000%), a level that is set to remain even with a gradual return to normality. Even

internationally, in about 3 out of 10 organisations more than 70% of employees will continue to work remotely in the next 2-3 years, compared to just over 10% before the lockdown (Anitec - Assinform, 2021).

Confirming the increase in digitisation among businesses, including medium and small ones, the number of remote workers rose from 570,000 in 2019 to over 6 million during the first lockdown in March 2020 (+1,000%), a level that is set to remain even with a gradual return to normality. Even internationally, in around 3 out of 10 organisations, more than 70% of employees will continue to work remotely over the next 2-3 years, compared to just over 10% before the health emergency. In 2020, the European Investment Bank's (EIB) analysis of investment areas does not show much change, with the largest share going to machinery and equipment (50%), similar to the EU average (49%). In the services sector, companies tend to invest less in machinery and equipment in favour of overall investment in software, data, information technology and websites. Manufacturing firms continue to have the highest share of investment in research and development. Companies most affected by the pandemic were more likely to opt for investments in new products, processes or services than those not adversely affected, which were more focused on investments in capacity expansion. The interaction between the processes of digital transformation and the impact of the pandemic crisis acted as an accelerator both of the demand for new digital skills and of the processes of obsolescence of ICT skills and professions at risk (due to a low degree of updating, a mix of skills no longer adequate to holistically manage technological, organisational and managerial complexities or complete substitution with new digital solutions) (Baige, 2020).

Finally, the type of workforce in Italy should also be considered: in 2021, an average of 4 million 588 thousand people between the ages of 55 and 64 worked in Italy, an increase of 1 million 775 thousand compared to 10 years earlier. This is what emerges from the latest tables on employment in Europe released by Eurostat (2021), according to which in the same period employment in the older age bracket grew in the EU by more than 11 million units. Thanks to reforms that have increased the age of access to retirement and to demographic trends, 53.4% of people aged between 55 and 64 will be working in Italy in 2021, an increase of 15.9 percentage points. The figure is even more pronounced for women (+16.1 points, from 27.9% to 44%).

2. Goals of the study: the online survey on digital transformation and occupational health and safety

Digital innovation and technological advances have brought about changes in the organisational-management sphere and have had an impact on living and working environments and on working conditions themselves. These changes can have positive effects for workers in terms of improved quality of work and work-life integration, however, this digital transformation can introduce new risks to workers' health and safety (Pietrafesa, 2019).

The COVID-19 emergency has accentuated the scale of the challenge that automation already posed before the pandemic, namely that of providing workers with new skills and/or updating existing ones to cope with the continuous and rapid changes in the labour market. In such a context, it is particularly important to investigate the introduction of robotics, automation and digital technologies into the workplace, which increase the level of complexity in the management of work activities and bring

about changes brought about by the digital transformation in production processes that introduce new health and safety risks that require appropriate risk management. One important aspect to be investigated concerns workers' perceptions of the use of technology and automation in work contexts. From the systematic review, an ad hoc questionnaire was developed to carry out an online survey to analyse workers' perceptions of the use of technology and automation in the workplace. The survey is part of the research activities conducted as part of the BRIC Inail 2019-2021 project ID 50: *Analysis of risks and mitigation tools for the protection of workers' health and safety in work contexts subject to digital transformation*, by the Department of Medicine, Epidemiology, Occupational and Environmental Hygiene, Inail, in collaboration with the Department of Mechanical and Aerospace Engineering, University of Rome "La Sapienza", the Department of Law, Economics, Politics and Modern Languages, LUMSA University and the Department of Philosophy and Educational Sciences, University of Turin¹.

The aim of the survey is to analyse the impacts of digital transformation on workers' health and safety.

3. Materials and methods

A cross-sectional questionnaire survey was conducted in Italy among workers from May to September 2021 through different multimedia channels, in order to reach a wide and varied target at the national level, specifically the following platforms were used: Site project tra.d.a.r.s. (www.tradars.it), Facebook, Twitter, LinkedIn and WhatsApp, based on a communication plan daily updated. Direct mailing was used as well. The questionnaire was distributed through the Microsoft Form online platform complemented by an informed consent form; the participation was voluntary and anonymous. The estimated completion time was around 10/15 minutes. Data were collected, stored and analysed according to the Regulation on the protection of natural persons with regard to the processing of personal data (GDPR - Regulation 2016/679). The reference sample is a convenience sample.

The areas investigated included the introduction and use of digital technologies, work organisation, regulatory and health and safety aspects, training and skills development of workers. The questionnaire consisted of 30 questions, including the socio-anagraphical section consisting of 12 questions.

A mono and bivariate analysis was carried out using the SPS programme of the data from the questionnaire administration, which was completed in September 2021.

A total of 372 subjects participated in the survey, of which 300 questionnaires were considered valid, as those in which no occupation and no introduction of digital technologies in the work context in the last three years were reported were excluded. Considering the socio-anagraphic characteristics of the workers involved in the survey, a considerable difference emerges with respect to gender, taking into account that 63% of the sample is made up of women and 37% of men, the average age is about 49 years. The respondents are equally distributed between the public sector (49%) and the private sector (51%), they are classified as white-collar workers in 41% of cases, as managers and middle managers in 27%, as executives in 11% and they have an open-ended contract (76%). The level of education is

¹ Tra.d.a.r.s. project: - Digital Transformation - Analysis - Risks - Safety - Analysis of risks and mitigation tools for the protection of workers' health and safety in work contexts subject to digital transformation. Project financed by Inail within the framework of the Scientific Research activities in collaboration named BRIC 2019 - Plan of research activities 2019/2021

high, with the majority of respondents having a university degree (45%) and a postgraduate qualification (30%). Looking at the size of the organisation, 46% of the subjects work in structures with more than 250 employees, 24% between 50 and 249 employees, 17% between 1 and 9 and 13% between 10 and 49 employees.

4. Results

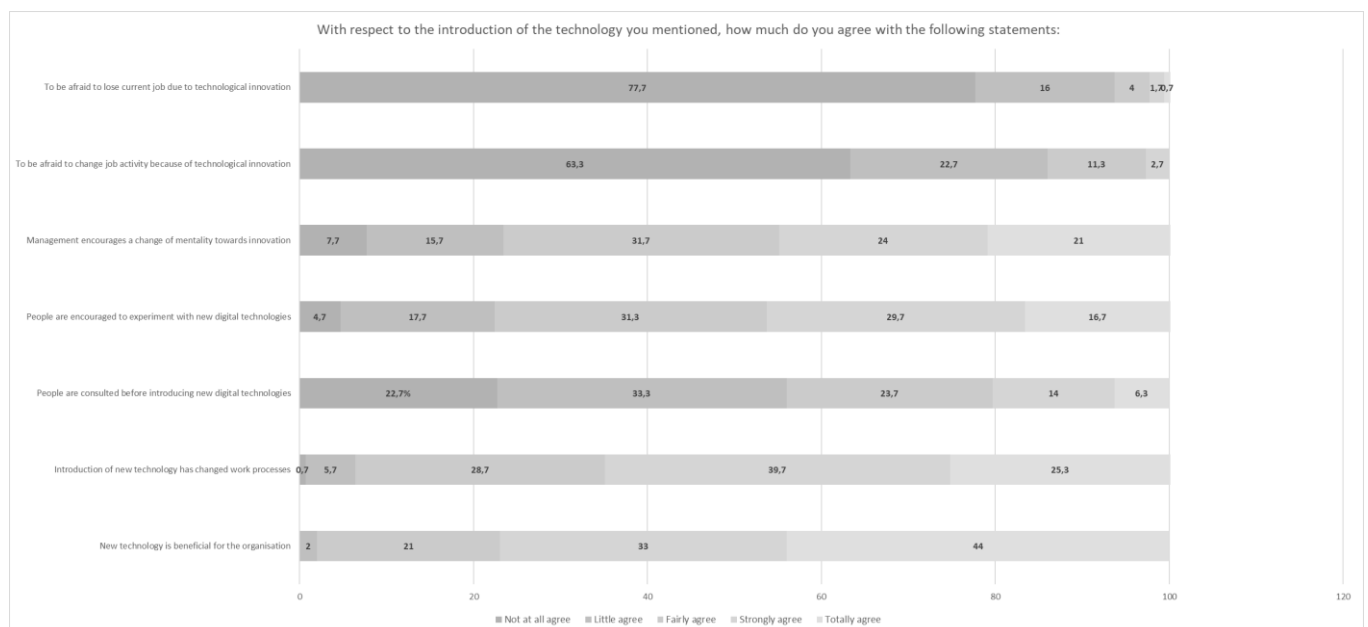
Regarding the benefits of digitalisation, the uniqueness of the circumstances makes it appropriate to consider a particular indicator the ability to react to the crisis. Despite the different impact of closures on the various sectors, digitalisation has allowed the most digital-intensive organisations to face the difficulties of the economic crisis with greater dynamism, as shown by ISTAT (2021). The companies with the highest productivity (advanced proactive) were the most responsive to the crisis, while the less productive units, with lower than average employee education and more oriented towards local or national markets, suffered the most. For advanced proactive firms, the value added per employee (in 2018) was more than double that of static firms in the crisis (around €73,000 compared to just over €33,000) and the average number of years of schooling of their employees was at least two years higher than average. At the sectoral level, the most reactive companies in the industrial sector are in the chemical, pharmaceutical, electronic and beverage sectors, while among the services, the profiles that have reacted most to the crisis are to be found in telecommunications, IT, finance and insurance. By class of employees, dynamism in the face of the crisis is clearly greater among large companies. Among the companies that suffer most from the crisis, regardless of sector and size, there is a high percentage of those that do not consider it useful to invest in any area (R&D, human resources, technology and digitalisation, human capital and training, internationalisation, social and environmental responsibility), do not adopt any strategic change and maintain a prevalently conservative attitude towards the digital transition. In accordance to ISTAT as of November 2020 production units with at least 3 employees do not seem to experience a very significant impact of smart working/telework on their activity overall: more than half of the enterprises report no effects on productivity, operating costs, efficiency, investments in staff training, adoption of new technologies. In the cases where remote working has produced results, these differ according to the aspect of business activity considered, and seem to present the traits of short-term effects linked to major organisational and technological changes. The most frequent effects tend to be negative consequences on productivity and business efficiency (as well as, as expected, on employees' interpersonal relations). Predominantly positive effects are observed on staff well-being and on aspects related to investments in intangible capital, i.e. the adoption of new technologies, and, to a lesser extent, on those in staff training. These results could signal specific trends in different segments of the production system, depending on whether the diffusion of remote working tends to close or accentuate already existing efficiency gaps. The first indications are in favour of divergent performances: companies that report positive effects of smart working/telework on productivity, efficiency, adoption of new technologies and operating costs are significantly larger and more productive than those that report negative consequences. The reason is partly linked to the sector of economic activity: the benefits of remote working tend to be seen more frequently in the service sector, particularly in market services (transport, publishing, insurance, R&D) (ISTAT, 2021).

Turning to the analysis of the results of this study, among the technologies most used by the sample surveyed, it emerges that 82% of respondents use collaborative platforms with a frequency of use of several times a day in 58% of cases and at least once a day in 21% of cases. The 70% of respondents say they have intermediate digital skills (using spreadsheets, cloud, collaboration platforms, social media, slide presentations), 24% advanced digital skills (managing sites, data, programming, platforms) and 6% basic digital skills. These data show a trend that is not in line with the national human capital data of the 2021 digitisation index of the economy and society compiled by the European Commission, which show that only 42% of people aged 16-74 have at least basic digital skills (56% in the EU) and only 22% have more than basic digital skills (31% in the EU) (European Commission, 2021). This result could be done by the type of survey respondents who have a high level of education and medium to high professional skills.

Within our survey sample it results that the digital technology can cause the following risks to their health and safety at work: psychological factors 31.1%, ergonomic factors 29.8%; 11% physical agents; 9.4% work organisation; while 11.7% do not see any risks. Concerning the perception of the consequences of the use of technology, 64% of the sample believe that it does not cause accidents or illness in the workplace, while 29% believe that it can cause occupational diseases and only 1% non-fatal accidents.

With respect to the introduction of the technology the 93.7% of respondents state that new technology has changed work processes (25.3% totally agree, strongly agree 39.7%, 28.7% fairly agree), improving the company's benefits (98%) (Figure 1).

Fig. 1: With respect to the introduction of the technology you mentioned, how much do you agree with the following statements?



Despite the positive process changes, workers are not consulted before introducing new technologies (56%) and thus suffer it. The 93.7% of workers are not afraid of losing their jobs when automation processes take place, because the sample is composed by workers with stable contracts. While the

literature on technology and job security has so far focused on workers' perceptions of insecurity, on the one hand, and their technological awareness or potential exposure of jobs to substitution, on the other hand job insecurity is related to the technological innovations actually adopted by the firms in which workers are employed. The adoption of technological innovations by firms tends to reduce the level of job insecurity perceived by workers. The adoption of a technological innovation by a firm is perceived by workers who remain active as a signal of the health of the firm and its commitment to preserving the business. This reassuring effect of technological innovations, however, differs between firms and workers due to the mediating role played by certain factors. While personal traits are not particularly relevant, workers' previous experiences associated with the introduction of the innovation in the past seem to have the greatest importance. In fact, the reassuring effect of technological innovations is stronger when workers are aware that the company has invested in technology-related training programmes, when they have not seen workers laid off after (and because of) the introduction of new machines in the past, and when their jobs have not changed much because of the innovation (Caselli, 2021).

Workplaces are becoming increasingly complex and subject to rapid change, tasks are becoming less routine and require continuous development of knowledge and skills (Ras, 2017). The workplace acquires an additional complexity as it sees the co-presence of four distinct and different generations. (Behie, 2017). This dynamic presents new challenges and opportunities that must be managed while also taking into account the different training needs and skills required for the safe use of different technologies.

The acquisition of new skills, which are indispensable for performing new tasks and adapting to the changes induced by digitisation and automation, is a priority objective of workers' training paths. Generally speaking, the realisation of the potential of digitisation always requires a redesign of the content of the work activity (Brynjolfsson, 2018) and often, through new technological investments, alongside the increased demand for the new professional profiles to be included in the company there is always an increased demand for training. In this sense, it is considered particularly useful to verify "how much training can favour the process and whether, in the final analysis, it can be considered an effective and operational driver of change" (Ferri, 2017).

In order to understand and deepen the aspects related to the role of training in relation to the introduction and use of new technologies, the different phases that characterise training processes have been investigated, including aspects concerning the objectives, training strategies, delivery methods and course contents. In order for training to be effective and lead to real change in the daily exercise of work tasks, it is essential that the choices in the different phases are coherent and commensurate with real needs (Stabile, 2016).

In order to translate this into effective change in the daily exercise of work tasks, three interconnected points could be underlined:

- innovation training design must be carried out with the active involvement of the responsibility and co-ordination figures who actually work in close contact with the workers to be trained, ensuring that this takes place in all phases, from the definition and focusing of the objectives to the follow up;
- the objective of the initiative must be precise, verifiable and not generic, it cannot be limited to the definition of the learning objectives but, with the help of the company manager, it must exhaustively define the new functions and tasks that the trained worker will have to perform;

- the training methodology must be defined in line with the real needs, avoiding as far as possible the preconceived positions that have conditioned the recent debate. In this sense, learning by doing is not always suitable, and classroom hours should not always be limited. As Ferri (2021) highlights in the ROLA survey, one of the advantages of the introduction of new digital technologies consists precisely in the questioning of formulae of convenience.

In the present study, it must be underlined that only 54% of respondents claim to have received training on the use of technology, through simulation activities (18%), frontal transmissive lessons (12%), practical exercises (7%), lessons based on dialogue and confrontation between teacher and learner (7%) and alternating use of lessons and exercises and/or simulations (10%). This figure differs from the national figure in the DESI 2021 report in which only 15% of Italian companies provide ICT training to their employees, five percentage points below the EU average.

Analysing the mode of delivery of the courses in this study, it emerges that 34% attended courses in synchronous video conference², 32% in e-learning³, 31% in fad⁴, 17% in mixed didactics⁵, and 17% in presence. The data on the mode of delivery of the courses are probably influenced by the fact that during the period of the health emergency a measure to contain the spread of the Sars-CoV-2 virus was identified in the different modes of distance learning. In 52% of the cases, the training objectives concerned the ability to use technology in one's work; in 34% the information on the use of technology in one's work; in 34% the ability to use technology in one's work; in 23% the ability to use technology in one's work, without compromising one's health and safety. Those who had attended training courses were asked to indicate, using a 5-step Likert scale (1= not at all agree, 5= completely agree), the degree of agreement with the complexity of the training content and the difficulties encountered with regard to the training delivery methods. In general, the answers provided show that the contents of the training were found to be complex to understand in 30% of cases (quite agree 22%; very agree 6%; completely agree 2%), while the training delivery method was considered difficult to use in only 18% of cases (quite agree 15%; very agree 2%; completely agree 1%).

A question was prepared to allow participants to indicate possible areas for improvement through training: 61% of the answers indicated digital technologies and work tools, 41% privacy and data security, 22% responsibilities and health and safety protection, 20% health and safety risks in relation to their own activity.

Bivariate analysis of socio-anagraphic variables with variables relating to training and skills development shows that among university graduates and those with a postgraduate qualification, those who have not received any training in the use of technology are 46% and 32% respectively. The majority of those who live in the south and islands of our sample have not received any training in the use of technology (53.3%), which is significantly higher than those who live in the centre (46.2%) and the north (44.4%). In the ROLA 2021 survey developed in cooperation between Inapp and Fondimpresa, it was observed that the differences in training are significant between the north, the centre and the south. Respectively, the average level of knowledge is associated with an increase of 19.5% in the north, 20% in the centre and 7.8% in the south if the individual has done a course in digital technologies.

² Streaming learning courses involving co-presence of learners and lecturers interacting with each other.

³ FAD or online courses with attendance tracking and tutors without the co-presence of learners and lecturers.

⁴ Live or recorded self-study fad learning courses.

⁵ In-presence and distance modes.

In the sample, workers who have not received any training on the use of technology in the private sector is 50%, while in the public sector is 42.7%. E-learning courses were followed by 41.3% in the private sector and only 23.5% in the public sector. With regard to synchronous video-conferencing courses, the opposite trend can be observed: 43.6% in the public sector and 22.6% in the private sector. Among the employees of small enterprises, those who did not receive any training on the use of technology accounted for 60.7%, of whom 51.3% had an advanced level of competence, 50% a basic level and 44.2% an intermediate level. With regard to the objectives of the training, there were no significant differences between the two sectors examined: information on the use of technology in one's work (private 33.7% and public 34.4%); making people able to use technology in their work (private 50% and public 52.8%); making people able to make the best use of technology in their work (private 34.2% and public 32.9%) and making people able to make the best use of technology without compromising their health and safety (private 27.1% and public 19.7%).

In a recent study conducted by Inapp a positive and significant correlation emerges between the adoption of digital technologies and new recruitment. More precisely, digital technologies positively affect the hiring rate of young workers. They do not find clear evidence of an increased demand for skilled labour in association with new technologies, but there is evidence of positive associations with on-the-job training, the share of trained employees and training costs per employee. However, companies can also create specific in-house skills through on-the-job training. Investments in both formal education and on-the-job training can increase the complementarity of technology and e-skills, making the introduction of I4.0 technologies more profitable for firms. Investments in training are positively associated with the adoption of KETs in Italian firms. Indeed, training can be designed internally by individual employers according to the specific needs of firms. The results confirm this synergy between on-the-job training and digital technologies, showing a positive association between the implementation of on-the-job training, the share of trained employees in total employment and the (log) of training costs per employee. The 4.0 technologies increase the share of trained workers by 3.5 percentage points, while the average cost of training increases by €30 per employee compared to non-adopting firms. Italian firms that have invested in 4.0 technologies have increased on-the-job training by widening the pool of workers receiving training and increasing the average amount spent on training per worker (Cirillo, 2022).

With regard to the legal/regulatory aspects related to the use of technology, the role of trade union representatives, respect for working breaks and the protection of personal data were explored in this study.

Analysing the role of trade union representatives in the process of introducing technologies, the respondents were asked to indicate, using a 5-step Likert scale (1= not at all agree, 5= completely agree), the degree of agreement with respect to the perception of the role played by trade union representatives in the introduction phase of new technologies or in the phase of choices by public and private organisations.

In general, the answers provided showed that while there is a uniform degree of agreement on the perception of knowledge of regulatory provisions, health and safety protection and clarity of procedures and guidelines, there is a lack of relevance with regard to the role played by trade union representatives in the process phase of technology introduction. In fact, 41.3% are not agree at all on the role (not played) by trade union representatives in the process of technology introduction,

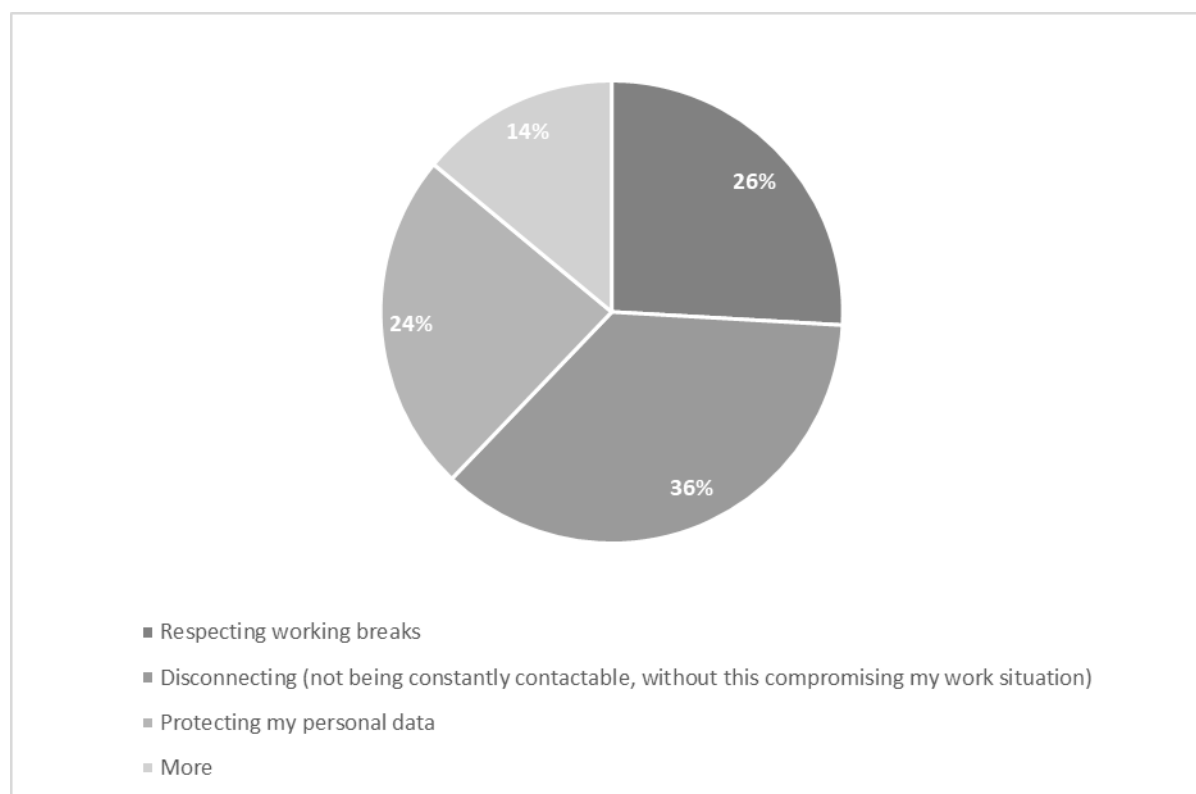
compared to 28% who little agree, 22.7% who fairly agree, 6% who strongly agree and 2% who completely agree.

Passing from the phase of introduction of technologies to the next phase "of the use of technology" it was asked to indicate in case of a problem of health and safety in the use of technology to whom he/she turns: it is evident that a significant proportion of respondents prefer to turn to the employer (33%), health and safety manager (23%), occupational doctor (18%) while only a marginal percentage turns to the workers' representative (6%). However, it is worth noting that 31% of the respondents stated that they did not refer to any of the figures responsible for health and safety management.

The automation of processes also involves the specific risk of replacement of workers and with consequence on the always online, work-related stress, less investment in safety which will probably have the role of complicating the transition from old to new jobs. In any case, technological progress will never be able to make human labour definitively useless or prove very detrimental to it. It is necessary to improve the positive aspects of the technological progress that will continue to have important areas of application through which to respond to the needs of people and society.

A large proportion of respondents of this study perceive a lack of respect for work breaks (26% of answers) and a low perception of feeling that their personal data is protected (24% of answers) following the introduction of technology (Figure 2).

Fig. 2 The introduction of this technology allows to:



The increasingly widespread use of algorithmic systems to manage and process huge flows of data poses problems not only in relation to the protection of privacy, to be understood today as everyone's right to keep control of their personal data, but also with regard to the principle of equality and non-discrimination, with repercussions on workers' health. In particular, as highlighted by the European

Agency for Safety and Health at Work, the transparency and ethics of the decisions of artificial intelligence algorithms have a far from negligible impact on workers, on their trust and acceptance of such systems, as well as on their stress and anxiety levels and other aspects of their mental health, especially when they are unable to understand what is happening, what data is being collected and for what purposes (Eu-OSHA, 2018). Not to be overlooked is another major problem that has emerged recently, the so-called spill over phenomenon or time porosity, i.e. when work time affects private lifetime. The result has often been overworking, understood as working at all hours (Stabile, 2016; Pietrafesa, 2019).

5. Concluding remarks

Overall, this study shows that 92% of the sample is satisfied with the introduction of new technologies in the company (completely 12%, very 38%, fairly 42%).

On the other hand, there is still a significant percentage of workers who have not attended any training course on the use of technology in their work contexts highlighting that it is not good played the role that by training could have as a driver supporting the digital transition. A large part of the training is self-learning, but it would be unexperienced to think that such changes can be adequately addressed by relying only on the resources of individual workers, or that technological investment alone - user-friendly technology - is sufficient, ignoring the fact that the challenge is not so much technological as cognitive and cultural.

Over the next decade, as workplaces rapidly adopt automation technologies, we estimate that 94 million workers in Europe, about two out of five, will see 20% of their jobs taken over by machines. Some 21 million of them will have to change jobs.

The creation of new career paths will therefore be essential to move workers out of a shrinking pool of low-end jobs and into jobs with brighter prospects. For now, we find that most Europeans who change occupations tend to move from a declining occupation, such as office support, production and customer service, to other declining occupations; or from a growing occupation, such as STEM occupations or business and legal professionals, to other growing occupations, and that there is little crossover.

All stakeholders have a role to play in addressing this skills challenge. This includes employers, who will need to work with governments, educators and the social sector. Companies are key players in this equation, as they have a clear vision of the roles that are growing and the skills needed by workers to fill these roles. They will also be among the first to suffer from a skills shortage of the workforce they need in the age of automation.

Excessive demands on the workforce and the absence of technical and organisational support represent critical issues related to work organisation models and the impact on workers' health, in terms of technostress. These criticalities can be addressed through strategies focused on reducing the demands placed on workers, redesigning work and technology, and implementing resources in terms of technical support, training and worker participation.

A successful strategy in the digital transition phase implies for the organisations an increase in productivity and a reduction in labour costs, for the worker a humanisation of the working relationship, especially through the adoption of adequate safety measures at work, and for the trade unions the possibility of creating wider spaces for participatory bargaining.

References:

- Anitec-Assinform. (2021). *Il digitale in italia 2021: Mercati, Dinamiche, Policy*. Confindustria digitale, 52 edizione.
- Baig, A., Hall, B., Jenkins, P., Lamarre, E., & McCarthy, B. (2020). The COVID-19 recovery will be digital: A plan for the first 90 days. *McKinsey Digital*, 14.
- Behie, S. W., & Henwood, M. K. (2017). Meeting the future organizational and technical training challenges of a changing workforce. In *Global Congress on Process Safety 2017-Topical Conference at the 2017 AIChE Spring Meeting and 13th Global Congress on Process Safety* (Vol. 1, pp. 274-286).
- Berg, J., Hilal, A., El, S., & Horne, R. (2021). World employment and social outlook: Trends 2021. *International Labour Organization*.
- Brynjolfsson, E., Mitchell, T., & Rock, D. (2018, May). What can machines learn, and what does it mean for occupations and the economy?. In *AEA papers and proceedings* (Vol. 108, pp. 43-47).
- Caselli, M., Fracasso, A., Marcolin, A., & Scicchitano, S. (2021). *The reassuring effect of firms' technological innovations on workers' job insecurity* (No. 938). GLO Discussion Paper.
- Cirillo, V., Mina, A., & Ricci, A. (2022). Digital technologies, labor market flows and investment in training: Evidence from Italian employer-employee data.
- Costantino, F., Falegnami, A., Fedele, L., Bernabei, M., Stabile, S., & Bentivenga, R. (2021). New and emerging hazards for health and safety within digitalized manufacturing systems. *Sustainability*, 13(19), 10948.
- European Commission. (2021). *Digital Economy and Society Index* (DESI).
- EU Regulation 2016/679-General Data Protection Regulation-GDPR-application from 25 May 2018.
- Eurostat. (2021). (Last online consultation May 2022).
https://ec.europa.eu/eurostat/databrowser/view/LFSI_EMP_A__custom_3000106/default/table?lang=en
- Ferri, V., Guarascio, D., & Ricci, A. (2017). Formazione professionale, innovazione e investimenti in capitale fisico.
- Ferri, V., Nobili, D., Tesauro, G., & Ferri, S. (2021). Formazione continua e innovazione tecnologica nelle macro-aree italiane: evidenze dall'indagine ROLA.
- ISTAT. (2021). I profili strategici e operativi delle imprese italiane nella crisi generata dal Covid-19. (https://www.istat.it/it/files//2021/01/Nota_analisi_Indagine_Covid_imprese_11genn2021.pdf). Last online consultation May 2022
- Pietrafesa, E., Bentivenga, R., Stabile, S., & Iavicoli, S. (2019). Digital transformation in organizations: The impact on working life quality and new risk factors. In *Proceedings of the Multi Conference on Computer Science and Information Systems, MCCSIS* (pp. 433-436).
- Pietrafesa, E., Bentivenga, R., Stabile, S. (2018). Il lavoro che cambia: mettiamo al centro l'impatto della trasformazione digitale. ForumPA (<https://www.forumpa.it/riforma-pa/smart-working/il-lavoro-che-cambia-mettiamo-al-centro-limpatto-della-trasformazione-digitale/>). Last online consultation May 2022
- Ras, E., Wild, F., Stahl, C., & Baudet, A. (2017, June). Bridging the skills gap of workers in Industry 4.0 by human performance augmentation tools: Challenges and roadmap. In *Proceedings of the 10th*

International Conference on Pervasive Technologies Related to Assistive Environments (pp. 428-432).

Santonastaso, R., & Macchioni, R. (2022). An Exploratory Study of the Digital Competences of Italian Accountants: Some Preliminary Results. *International Journal of Business and Management*, 17(2).

Stacey, N., Ellwood, P., Bradbrook, S., Reynolds, J., Williams, H., & Lye, D. (2018). Foresight on new and emerging occupational safety and health risks associated with digitalisation by 2025. Luxembourg: European Agency for Safety and Health at Work. (<https://osha.europa.eu/en/publications/foresight-new-and-emerging-occupational-safety-and-health-risks-associated/view>). Last online consultation May 2022

Stabile, S., Bentivenga, R., Pietrafesa, E., & INAIL. (2016). *ICT e lavoro: nuove prospettive di analisi per la salute e la sicurezza sul lavoro*. Inail. (<https://www.inail.it/cs/internet/comunicazione/pubblicazioni/catalogo-generale/pubbl-ict-e-lavoro-nuove-prospettive-di-analisi.html>). Last online consultation May 2022

Stacey, N., Ellwood, P., Bradbrook, S., Reynolds, J., Williams, H., & Lye, D. (2018). Foresight on new and emerging occupational safety and health risks associated with digitalisation by 2025. Luxembourg: European Agency for Safety and Health at Work. (<https://osha.europa.eu/en/publications/foresight-new-and-emerging-occupational-safety-and-health-risks-associated/view>). Last online consultation May 2022