Accounting for humans in establishing a digital workplace: insights from the education and health care sectors

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Abstract

Digitization reconfigures organizational dynamics and human resource management practices. COVID-19 accelerated the digital transition of many organizations which have been relatively less affected by pervasive digitization, such as educational institutions and health care organizations. Literature has warned of the potential side effects of digitization on psycho-social risks at work. However, empirical evidence is ambiguous. The article intends to advance what we currently know about this issue, investigating the digitization's implications on psycho-social risks at work in education and healthcare. A probit regression model was designed to collect evidence of digitization's implications on 5 types of psycho-social risks at work, i.e.: time pressures; poor interpersonal relationships; job insecurity; difficulties in interacting with users; and irregular working hours. A large sample of 8,460 organizations was involved in the analysis, including 4,920 health care companies and 3,540 educational institutions. Digitization determined longer working hours and greater job insecurity in the education sector. Moreover, it negatively affected social exchanges at work. Whilst it increased time pressures, it did not endanger the relationship between providers and users. Digitization had severe negative implications also for people working in health care, too. In particular, it had backlash on time pressures and job insecurity. Besides, it impaired interpersonal relationships and created barriers in patient-provider relationships. Finally, yet importantly, it prolonged working hours. Health promotion activities implemented at work were effective in curbing the drawbacks of digitization on psycho-social risks at work. Organizational interventions aimed at assessing psycho-social risks and at preventing them seemed to increase the acknowledgement of stressors in the workplace. In sum, digitization has major implications on psycho-social risks at work. Entailing an intensification of work, it may enact time pressures, undermining employees' well-being. Recontextualizing working dynamics in the cyber-physical domain, it may disrupt social exchanges, damaging the service experience quality. Digitization may also have indirect effects on the employees' quality of work, paving the way for a greater job uncertainty, which is heralded by the unfolding automation of work. Health promotion initiatives aimed at addressing the negative implications of digitization on employees' well-being at work by recovering a "human touch" in human resource management practices are especially effective in reducing psycho-social risks. The article tackles a timely and relevant topic, investigating the digitization's implications on psycho-social risks at work. The research findings and implications are relevant to deal with the challenges that companies all over the word will face in the post-COVID-19 era.

Keywords
Digitization; Education; Health services; Psycho-social risks; Well-being

1. Introduction

Workplace digitization, *i.e.* the pervasive use of Information and Communication Technologies (ICT) and digital tools to accomplish organizational tasks, is one of the biggest challenges faced by modern organizations (Hirsch-Kreinsen, 2016). On the one hand, digitization paves the way for the achievement of significant institutional, organizational, and individual gains (Briken *et al.*, 2017). Actually, it enables the design and the implementation of tailored working arrangements for disadvantaged people in a perspective of fair and inclusive employment (Giakoumis *et al.*, 2019), it expands the Human Resource Management Practices (HRMP) available to organizations in order to foster the individual contribution of employees to organizational excellence (Srinivasan *et al.*, 2020), and it allows people to benefit from a greater flexibility and adaptability of working arrangements (Ahlers, 2016). On the other hand, digitization has been argued to generate some negative backlash on the employees' ability to perceive meaningfulness at work (Ware and Stucky, 2018). More specifically, previous studies have emphasized that digitization may hamper social exchanges and direct inter-personal relationships amongst employees, desensitizing the working environment (Palumbo, 2021$_a$). This implies shortcomings on well-being at the individual and collective levels, due to an exacerbation of the sources of psycho-social stress at work (Palumbo, 2021$_b$).

The consequences of the COVID-19 pandemic – especially the prescriptions of social distancing issued by national and international governing bodies (Converso *et al.*, 2021) – have accelerated the digital transition of organizations across the globe (Narayanamurthy and Tortorella, 2021). Recontextualizing management processes and practices in the cyber-physical setting, digitization enacts remote working arrangements and empowers people to contribute to organizational performances out of the conventional working environment (Veith and Dogaru, 2020). From this standpoint, the digitization of work has been exploited to avoids the disruption of organizational processes triggered by social distancing and to sustain the continuity of value creation activities (Leonardi, 2021). This is especially true for several economic sectors which, in the past, have been relatively less affected by the disruptions in daily work processes brought by digitization, such as education and health care (Menvielle *et al.*, 2017).

Drawing on these introductory considerations, the digitization of work should be understood as a double-edged sword (Palumbo *et al.*, 2021). Whilst is facilitates the recontextualization of work in the cyber-physical domain, thus setting the conditions for flexible and remote working arrangements, it may also produce relevant sources of stress for employees (Diebig *et al.*, 2020). In particular, the pervasive use of digital tools and ICTs may determine an extensification of work, which is conducive to irregular working hours and increased time pressures, thus generating a greater difficulty to cope with work-related worries and concerns (Perrons *et al.*, 2005). In addition, digitization is expected to undermine the remote employees' organizational identification and the exchange of tacit knowledge and information (Donnelly and Johns, 2021). Employees undergoing a digitization of their working arrangements may feel disconnected from people sticking to traditional working arrangements, with negative effect on organizational commitment (Wang *et al.*, 2020). These phenomena entail side effects on employees' psycho-social well-being, harming their willingness and effectiveness to partake in advancing organizational excellence (Palumbo, 2021$_b$).

Digitization's side effects on psycho-social well-being are particularly relevant in service industries, such as health care and education, where face-to-face exchanges between users and providers and collaboration amongst peers are key ingredient of the recipe for organizational excellence (Quinn *et al.*, 2009; Mosadeghrad, 2014). However, to the best of the authors' knowledge, there is still limited evidence of the implications of digitization on psycho-social stressors at work perceived by people employed in the education and in the health care sectors. The article aims at filling in this gap in the scientific literature, articulating an empirical analysis

on two large samples of Europeans working in the fields of education and health care. This empirical research was conceived of as an attempt to answer the following research questions (R.Q.):

> R.Q. 1: Does digitization determine increased psycho-social risks at work?
>
> R.Q. 2: How can organizations address digitization's side effects on psycho-social risks at work?

The article is organized as follows. Section 2 proposes the conceptual framework which underpinned this study; furthermore, it advances the research hypotheses which were tested in the empirical analysis. Section 3 describes the research methodology and briefly present the study samples. Findings are reported in Section 4 and, next, they are critically discussed in Section 5. Section 6 concludes the article, emphasizing its main conceptual and practical implications.

2. Conceptual background

Digitization of work reframes the human experience of working commitments, triggering a greater focus on technology, rather than on human touch in the configuration of organizational dynamics and processes (Ware and Stucky, 2018). It may take different shapes, ranging from the increased use of personal computers and digital devices for accomplishing traditional organizational activities (Jarrahi *et al*., 2021) to robotization, automation (Moraliyska, 2021), and the development and implementation of wearable tools to advance individual skills and capabilities (Alvarez *et al*., 2016). Digitization has achieved a growing relevance in the health care domain, where it has been further stimulated by the drawback of the COVID-19 pandemic (Khan *et al*., 2020). *Inter alia*, health care organizations have attempted to take advantage of digitization in order to foster the delivery of advanced health services by reducing risks related to the spread of the epidemic (Zemmar *et al*., 2020). Moreover, wearables and innovative digital technologies enhance the ability to collect timely and relevant health-related information which inspire appropriate and effective health promotion and risk prevention interventions (Jennath *et al*., 2020). Similarly, education is rapidly progressing towards a 4.0 approach, which is intended to exploit digital resources and technologies in order to ensure the users' access to continuous and compelling learning experiences (Ciolacu and Svasta, 2021).

Digitization of work may have some negative implications on psycho-social risks faced by people in the workplace (Palumbo, 2021$_b$). Generally speaking, psycho-social risks concern "*…the likelihood of aspects of work organization, design, and management potentially causing physical or mental harm*" to employees (Langenhan *et al*., 2013: p. 88). Various risk factors can trigger negative effects on individual and collective psycho-physical well-being, such as time pressures and stress (De Sio *et al*., 2017), limited exchanges with others and poor social organizational climate (Leka *et al*., 2017), job insecurity (Kim and von dem Knesebeck, 2015), difficulties in interacting with users and relevant stakeholders (Akimova *et al*., 2020), and long or irregular working hours (Di Tecco *et al*., 2017). Firstly, as previously anticipated, digitization may engender an extensification of work, which put under stress the individual ability to effectively manage the interplay between work and life, creating time pressures (Hassard and Morris, 2021). Secondly, digitization constrains face-to-face interaction and rich exchanges amongst employees, producing major negative consequences on the psycho-social climate at work (Kawiana *et al*., 2021). In turn, this impairs the perception of well-being at work and increases perceived work-related stress (Palumbo *et al*., 2021). Thirdly, unbalancing the relationship between human and technology towards the latter, digitization has been also argued to determine more common feelings of job insecurity, which further reduces the perceived psycho-physical well-being (Abe *et al.*, 2021). Fourthly, the digitization of work completely

reshapes the exchange between users and providers, making it more difficult for the latter to build a positive relationship with users and to engage them in value co-creation (Lucivero, 2017). Fifthly, and lastly, the intensification of work and the adoption of an always on culture which is heralded by digitization entail increased risk of prolonged and/or irregular working hours, which greatly undermine individual psycho-physical well-being at work (Flecker *et al.*, 2017). Drawing on these considerations, it is assumed that:

> Hp. 1: Work digitization has negative implications on psycho-social risks at work.

Organizations should implement tailored initiatives in order to be prepared to accomplish the digital transition and to reframe their HRMP in light of the side effects of digitization on employees' psycho-social risks at work. The delivery of specialized occupational health services has been largely identified as an effective solution to cope with psycho-social risks at work and to enhance the employees' well-being (Nicholson, 2004). Occupational health includes a variety of initiatives, such as ergonomic services, psychological counseling, and risk prevention interventions (Macdonald and Sanati, 2010). Occupational health services enable organizations to be aware of the challenges to the psycho-social well-being of employees and fosters the design and the implementation of risk prevention and health promotion actions, that are conducive to positive implications on the individual and collective ability to deal with relevant work-related stressors (Kinnunen-Amoroso and Liira, 2016; McIntyre *et al.*, 2017). From this standpoint, it is assumed that:

> Hp. 2: The delivery of occupational health services curbs the perceptions of psycho-social risks at work.

Alongside occupational health services, organizational initiatives intended to promote healthy behaviors at work are crucial to overcome the worsened impact of psycho-social stressors (Parrish *et al.*, 2018). Health promotion initiatives consist of various initiatives, ranging from healthy nutrition to prevention of addition and encouragement of physical activity at work in a perspective of workplace wellness (Seward *et al.*, 2019). The arrangement of health promotion interventions has been argued to increase the individual capability to cope with the sources of stress at work and to achieve a better perceptions of psycho-physical well-being in the workplace (Payne *et al.*, 2012). Hence, it is assumed that:

> Hp. 3: The implementation of health promotion actions curtails psycho-social stressors at work.

Preventive actions intended to reduce the negative implications of digitization on the sources of psycho-social stress at work are also critical to avoid falls in individual well-being and promote a healthy work environment (Lindholm *et al.*, 2020). Preventive measures involve a mix of initiatives, including task rotation, provision of ergonomic equipment, and working hours' reduction, in an attempt to empower people to deal with technostress and to overcome the challenges on individual well-being triggered by digitization (La Torre *et al.*, 2019; González-López *et al.*, 2021). The greater the organizational commitment to the arrangement of preventive actions to address the sources of technostress, the better the individual and collective ability to perceive a positive working climate (Palumbo, 2021$_b$). In sum, it is hypothesized that:

> Hp. 4: The arrangement of organizational prevention measures reduces the psycho-social stressors perceived at work.

Organizations are likely to establish formal policies, procedures, and action plans to deal with the psycho-social risks triggered by the digitization of work (Tarafdar *et al.*, 2015). Such a proceduralization is primarily intended to achieve a greater awareness of the factors and phenomena which may undermine the perception of well-being at work (Diebig *et al.*, 2020) and to set the conditions for ensuring decent working arrangements for people (Toscanelli *et al.*, 2019). More specifically, the implementation of fitting policies, procedures, and plans enables people to cope with the sources of stress at work and to avoid a worsening of their

psycho-social status at work (Meyer and Hünefeld, 2018). Besides, it curbs the ambiguity generated by the digital transition and encourages employees to report relevant stressors, fostering efforts intended to overcome such stressors (Christ-Brendemühl and Schaarschmidt, 2019). In line with these considerations, it is assumed that:

> Hp. 5: The design of policies, plans and procedures to assess work-related stressors reduces the psycho-social stressors perceived at work.

Lastly, yet importantly, tailored HRMP should be designed in an attempt to empower employees to deal with psycho-social risks at work (Vrontis *et al.*, 2021). Such practices include a variety of interventions, ranging from involving employees to participate in organizational decision making and problem solving activities in order to address the negative implications of digitization on individual and collective well-being (Palumbo, 2021c) to training processes aimed at allowing people to develop the skills and the expertise needed to overcome psycho-social stressors at work (Wendsche *et al.*, 2021). The implementation of targeted HRMP allows organizations to prevent the negative impacts of digitization on psycho-social well-being at work. In light of these arguments, it is hypothesized that:

> Hp. 6: The arrangement of targeted HRMP enables organization to improve the perceived psycho-social well-being at work of employees.

Figure 1 shows a graphical synthesis of the conceptual background on which this paper was established, highlighting the hypothesized relationships amongst the main constructs investigated in this empirical research.

Figure 1. A graphical overview of the conceptual framework
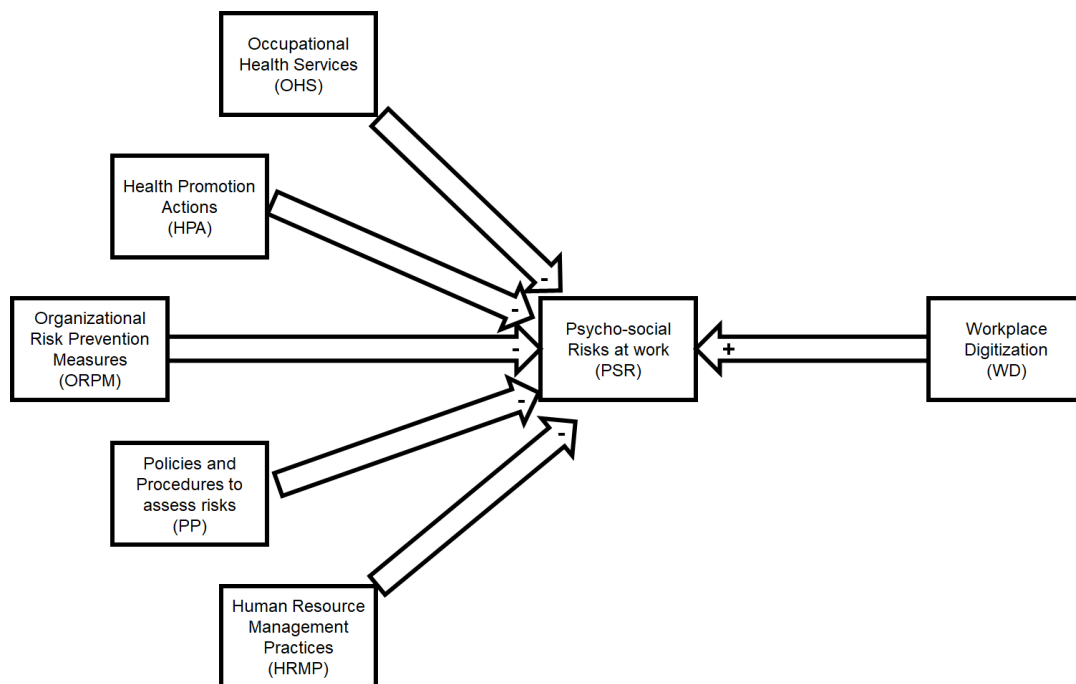
3. Methods

Secondary data were collected from the third wave of the European Survey of Enterprises on New and Emerging Risks (ESENER). It is a Pan-European survey sponsored by the European Agency for Safety and Health at Work with the aim of assessing general safety and health-related risks at work, gauge psycho-social risks in the workplace, and evaluate people participation in occupational health initiatives undertaken by organizations. The survey was

targeted to European companies with at least 5 employees and it was administered in 2019. Alongside the 27 member states of the European Union, Iceland, North Macedonia, Norway, Serbia, Switzerland and the United Kingdom were involved in the survey. For each unit of analysis, the respondent was represented by the manager or employee who got more information about the way safety and health risks are addressed at work. A Computer-Assisted Telephone Interviewing (CATI) technique was primarily use to administer the survey and collect data.

The secondary data collected from the ESENER were stored in an electronic worksheet, which was shared by the authors in order to identify the target population and to elicit the variables to be included in our empirical analysis. In line with the specific purposes of this study, only people who were employed in the education sector and in human health services were contemplated in this analysis. As reported in Table 1, the study sample consisted of 8,460 companies, which were evenly distributed across educational institutions (41.8%) and entities operating delivering human health services (58.2%). The different geographical areas of Europe were fairly represented. More specifically, about 8 in 10 companies were established either in Northern Europe (40%) or in Continental Europe (40.9%), with the remaining part being located in Mediterranean Europe (19.1%). Slightly less than a fifth of the units of analysis employed less than 10 people (18.8%); about half of the sample consisted of small and medium sized enterprises with a number of employees ranging between 10 and 49 people (47.4%); about 1 in 10 were large-sized institutions with more than 250 employees (10.2%). A large part of the companies had less than a quarter of employees aged 55 years or older (60.2%). Relatively few organizations were used to allow employees to remotely work from home (15.2%). Public sector entities owned about half of the companies involved in this research (51.9%).

Table 1. The sample composition (n = 8,460)

Variable	Total	
	No.	%
Sector		
Education	3,540	41.8
Human Health Services	4,920	58.2
Geographical area		
Northern Europe	3,382	40
Continental Europe	3,462	40.9
Mediterranean Europe	1,616	19.1
Organizational size		
Between 5 and 9 people	1,591	18.8
Between 10 and 49 people	4,014	47.4
Between 50 and 249 people	1,988	23.5
250 people and above	867	10.2
Proportion of the employees is aged 55 years or older		
None at all	897	10.6
Less than a quarter	4,196	49.6
A quarter to half or	2,457	29
More than half of your workforce	630	7.5
Do not know/Do not answer	280	3.3
Implementation of remote working arrangement		
Yes	1,286	15.2
No	7,139	84.4
Do not know/Do not answer	35	0.4
Ownership		
Publicly owned	4,389	51.9
Privately owned	4,022	47.5
Other/Do not know/Do not answer	49	0.6

Source: Authors' elaboration

The original ESENER dataset was carefully screened to pick items which were consistent with the dimensions included in our conceptual framework. Workplace Digitization (WD) represented the main independent variable run in the empirical analysis. In line with the multifacetedness of the digitization concept, different items were taken into consideration to gauge the degree of WD. More specifically, this variable derived from the aggregation of 6 dichotomous items, which were related to the use of ICTs, digital tools, and advanced technologies (such as, laptops, tablets, smartphones, wearable technologies, automated systems, and robotics) to accomplish organizational activities. WD was an interval scale variable, ranging from 0 (lowest degree of workplace digitization) to 1 (highest degree of workplace digitization).

Alongside WD, some additional factors were included as explanatory variables in statistical elaborations, consisting of the measures and initiatives undertaken by organizations to minimize psycho-social risks at work. In particular, attention was paid to five factors. Firstly, the delivery of Occupational Health Services (OHS) was investigated. Different OHS can be provided by an organization, in order to cope with stressors in the workplace. Services delivered by five different health professionals were accounted for to gauge OHS across the units of analysis: 1) occupational health doctor, 2) psychologist, 3) expert dealing with the ergonomic design, 4) generalist on health and safety, and 5) expert for accident prevention. Therefore, OHS derived from the aggregation of 5 dichotomous items, which assessed the availability and use of such services. It was an interval scale variable, ranging from 0 (no availability of occupational health services) to 1 (largest availability of occupational health services). Secondly, Health Promotion Actions (HPA) designed by the organization to enhance people's well-being at work were examined. Different measures are part of HPA interventions, including healthy nutrition, prevention of addiction, and sports activities at work and outside working hours. HPA derived from the aggregation of 4 dichotomous items, which reflected the implementation of health promotion actions at work. It was an interval scale variable, ranging from 0 (no health promotion initiatives at work) to 1 (largest provision of health promotion initiatives at work). Thirdly, Organizational Risk Prevention Measures (ORPM) intended to minimize the risks of fall on individual health status or the exacerbation of extant ill conditions were analyzed. Companies are used to design different interventions intended to prevent risks at work, such as task rotation, encouraging regular breaks for people in uncomfortable working positions, provision of ergonomic equipment, and the possibility for people with health problems to reduce working hours. In line with these consideration, ORPM was obtained from the aggregation of 5 dichotomous items, which assessed the availability of such services at work. It was an interval scale variable, ranging from 0 (no availability of preventive measures at work) to 1 (largest availability of prevention measures at work). Fourthly, Policies and Procedures (PP) directed at curbing psycho-social risks at work were contemplated in the analysis. Different organizational measures were acknowledged, including: the arrangement of an action plan to prevent work-related stress; the implementation of a procedure to deal with possible cases of bullying, harassment, threats, abuse, or assaults; the delivery of employee surveys including questions on work-related stress; and employees' formal involvement in identifying possible causes for work-related stress. Hence, PP was obtained from the aggregation of five dichotomous items, which assessed the existence of such procedures across the companies involved in this study. It was an interval scale variable, ranging from 0 (no arrangement of policies and measures to curb psycho-social risks at work) to 1 (significant arrangement of policies and measures to curb psycho-social risks at work). Fifthly, and lastly, targeted Human Resource Management Practices (HRMP) to deal with psycho-social risks at work were run in the statistical analysis. Different organizational actions were investigated, such as work reorganization, training on conflict resolution, customized interventions if excessively long or irregular hours are worked, and allowing employees to take more decisions

on how to do their job. HRMP derived from the aggregation of five dichotomous items, which assessed the use of such practices across the units of analysis. It was an interval scale variable, ranging from 0 (no use of practices to reduce risks at work) to 1 (largest use of practices to reduce risks at work).

The dependent variable was represented by the existence of Psycho-Social Risks at work (PSR). Drawing on the conceptual background reported above, five different forms of PSR were examined in this study: 1) time pressure, 2) poor communication or cooperation, 3) job insecurity, 4) interaction with difficult customers, and 5) long or irregular working hours. These five forms of PSR were assessed as dichotomous variables, with 0 indicating that the stress factor was not present in the workplace and 1 indicating that it was present. Table 2 includes an overview of the main measures which were investigated in this empirical research.

Table 2. The study measures

Variable (ID)	Definition	Scale/Code	Education			Human Health Services		
Independent variables			Obs.	μ	σ	Obs.	μ	σ
Workplace Digitization (WD)	Pervasiveness of ICTs, digital tools, and advanced technologies in accomplishing organizational activities	0 = lowest pervasiveness of digitization 1 = largest pervasiveness of digitization	3,540	0.33	0.12	4,920	0.33	0.15
Occupational Health Services (OHS)	Health services delivered by the organization in order to cope with psycho-social stressors at work	0 = no availability of occupational health services 1 = largest availability of occupational health services	3,540	0.52	0.30	4,920	0.56	0.31
Health Promotion Actions (HPA)	Variety of initiatives designed and implemented by the organization to enhance people's well-being at work	0 = no health promotion initiatives at work 1 = largest provision of health promotion initiatives at work	3,540	0.49	0.34	4,920	0.51	0.34
Organizational Risk Prevention Measures (ORPM)	Organizational actions intended to minimize the risks of fall on individual health status or the exacerbation of extant ill conditions	0 = no availability of preventive measures at work 1 = largest availability of prevention measures at work	3,540	0.44	0.28	4,920	0.61	0.28
Policies and Procedures (PP)	Design and implementation of tailored policies and processes aimed at curbing psycho-social risks at work	0 = no arrangement of policies and measures to curb psycho-social risks at work 1 = significant arrangement of policies and measures to curb psycho-social risks at work	3,540	0.33	0.27	4,920	0.35	0.27
Human Resource Management Practices (HRMP)	Arrangement of targeted human resource management practices to deal with psycho-social risks at work	0 = no use of practices to reduce risks at work 1 = largest use of practices to reduce risks at work	3,540	0.49	0.29	4,920	0.59	0.29

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	Dependent variable							
Time Pressures (PSR 1)	Existence of psycho-social stressors triggered by time pressure	0 = No 1 = Yes	3,521	0.52	0.50	4,901	0.57	0.49
Poor communication or cooperation (PSR 2)	Existence of psycho-social stressors triggered by poor communication or cooperation	0 = No 1 = Yes	3,515	0.23	0.42	4,879	0.30	0.46
Job insecurity (PSR 3)	Existence of psycho-social stressors triggered by job insecurity	0 = No 1 = Yes	3,492	0.20	0.40	4,877	0.16	0.37
Interaction with difficult customers (PSR 4)	Existence of psycho-social stressors triggered by interaction with difficult customers	0 = No 1 = Yes	3,528	0.78	0.41	4,906	0.82	0.38
Long or irregular working hours (PSR 5)	Existence of psycho-social stressors triggered by long/irregular hours	0 = No 1 = Yes	3,535	0.23	0.42	4,902	0.35	0.47

Source: Authors' elaboration

A probit regression analysis was designed to illuminate the implications of WD, OHS, HPA, ORPM, PP, and HRMP on psycho-social risks at work. More specifically, five different probit models were run in order to capture the effect of the independent variable on the five forms of PSR reported above. Elaborations were conducted on both the sub-sample of companies operating in the educational sector and on the sub-sector of institutions involved in the design and delivery of human health services.

4. Findings

Tables 3 and 4 summarize the outputs of the probit regression analysis which was undertaken for the purpose of this study. Whilst Table 3 focused on the implications of workplace digitization and organizational initiatives aimed at improving occupational health on psycho-physical risks at work, Table 4 concerned organizations operating in the human health services' sector. In both the Tables, the output of five models are reported, which dealt with the five forms of psycho-social stress contemplated in this research. More specifically, Model 1 concerned time pressures, Model 2 focused on poor communication and/or coordination with colleagues, Model 3 involved job insecurity, Model 4 dealt with the interaction with difficult customers, and Model 5 was related to long and/or irregular working hours.

Workplace digitization was found to trigger increased risks of psycho-social risks produced by time pressures in the education sector ($\beta = 0.50$; significant at the 0.01 level). Moreover, it was also found to pave the way for greater risks related to impoverished interpersonal relationships at work ($\beta = 0.69$; significant at the 0.001 level) and to job insecurity ($\beta = 1.11$; significant at the 0.001 level). Whilst WD did not pave the way for an extension of psycho-social risks produced by the interaction with difficult customers, it was positively and significantly related to stressors generated by long and/or irregular working hours ($\beta = 0.91$; significant at the 0.001 level). Interestingly, the provision of occupational health services was not significantly related to the existence of sources of stress at work deriving from time pressures, poor communications with colleagues, and job insecurity. However, it was negatively and significantly related to the appearance of psycho-social risks at work engendered

by the interaction with difficult customers (β = -0.27; significant at the 0.01 level) and by the occurrence of long and/or irregular working hours (β = -0.31; significant at the 0.001 level).

Table 3. The results of the probit regression analysis – Education Sector

Model 1

Likelihood Ratio χ^2	df	Sig.				
256.720	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-0.634	0.077	-0.785	-0.483	67.920	0.000
WD**	0.501	0.187	0.135	0.867	7.182	0.007
OHS	0.045	0.078	-0.108	0.198	0.334	0.563
HPA***	-0.352	0.069	-0.487	-0.216	25.873	0.000
ORPM***	0.412	0.089	0.237	0.587	21.249	0.000
PP***	0.829	0.092	0.649	1.008	81.948	0.000
HRMP***	0.446	0.084	0.282	0.611	28.242	0.000

Model 2

Likelihood Ratio χ^2	df	Sig.				
189.419	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-1.264	0.0848	-1.431	-1.098	222.533	0.000
WD***	0.688	0.2034	0.289	1.087	11.447	0.001
OHS	0.012	0.0867	-0.158	0.182	0.020	0.887
HPA***	-0.574	0.0777	-0.726	-0.421	54.487	0.000
ORPM***	0.604	0.0996	0.409	0.800	36.864	0.000
PP***	0.779	0.0994	0.585	0.974	61.435	0.000
HRMP	0.045	0.0930	-0.137	0.227	0.233	0.629

Model 3

Likelihood Ratio χ^2	df	Sig.				
83.536	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-1.502	0.0886	-1.676	-1.329	287.292	0.000
WD***	1.105	0.2075	0.699	1.512	28.387	0.000
OHS	0.051	0.0892	-0.124	0.225	0.322	0.571
HPA	0.011	0.0779	-0.142	0.164	0.020	0.888
ORPM	0.101	0.1015	-0.098	0.300	0.994	0.319
PP***	0.472	0.1018	0.273	0.672	21.501	0.000
HRMP	0.075	0.0955	-0.112	0.262	0.617	0.432

Model 4

Likelihood Ratio χ^2	df	Sig.				
294.896	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	0.383	0.0856	0.215	0.551	19.981	0.000
WD	0.381	0.2118	-0.034	0.797	3.245	0.072
OHS**	-0.270	0.0899	-0.447	-0.094	9.035	0.003
HPA***	-0.291	0.0784	-0.445	-0.138	13.819	0.000
ORPM	-0.005	0.1016	-0.204	0.194	0.003	0.958
PP***	1.713	0.1161	1.486	1.941	217.800	0.000
HRMP	0.155	0.095	-0.031	0.342	2.673	0.102

Model 5

Likelihood Ratio χ^2	df	Sig.				
294.896	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-1.266	0.0830	-1.428	-1.103	232.579	0.000
WD***	0.909	0.1978	0.521	1.296	21.106	0.000
OHS***	-0.307	0.0849	-0.474	-0.141	13.110	0.000
HPA***	-0.297	0.0754	-0.445	-0.149	15.508	0.000
ORPM***	0.439	0.0976	0.248	0.630	20.224	0.000
PP***	0.329	0.0984	0.136	0.522	11.148	0.001
HRMP***	0.457	0.0915	0.278	0.637	24.980	0.000

Table 4. The results of the probit regression analysis – Human Health Services' Sector

Model 1

Likelihood Ratio χ^2	df	Sig.

Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
392.972	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-0.810	0.0629	-0.933	-0.687	166.026	0.000
WD***	0.908	0.1332	0.647	1.169	46.496	0.000
OHS**	0.197	0.0660	0.068	0.326	8.931	0.003
HPA*	-0.148	0.0603	-0.266	-0.030	6.026	0.014
ORPM***	0.495	0.0771	0.344	0.646	41.147	0.000
PP***	0.677	0.0777	0.525	0.829	75.863	0.000
HRMP**	0.204	0.0715	0.064	0.344	8.132	0.004

Model 2

Likelihood Ratio χ²	df	Sig.				
307.870	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-1.280	0.0671	-1.411	-1.148	363.644	0.000
WD***	0.601	0.1362	0.334	0.868	19.503	0.000
OHS***	0.373	0.0704	0.235	0.511	28.114	0.000
HPA***	-0.247	0.0638	-0.372	-0.122	14.963	0.000
ORPM***	0.459	0.0824	0.297	0.620	30.994	0.000
PP***	0.744	0.0795	0.588	0.900	87.566	0.000
HRMP*	-0.152	0.0758	-0.301	-0.004	4.028	0.045

Model 3

Likelihood Ratio χ²	df	Sig.				
61.146	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-1.446	0.0746	-1.592	-1.300	376.092	0.000
WD***	0.833	0.1505	0.538	1.128	30.636	0.000
OHS	0.112	0.0785	-0.042	0.266	2.033	0.154
HPA	-0.070	0.0713	-0.209	0.070	0.952	0.329
ORPM	0.143	0.0916	-0.037	0.322	2.423	0.120
PP*	0.179	0.0898	0.003	0.355	3.989	0.046
HRMP	0.002	0.0845	-0.164	0.168	0.001	0.981

Model 4

Likelihood Ratio χ²	df	Sig.				
251.411	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	0.356	0.0700	0.219	0.494	25.915	0.000
WD**	0.433	0.1550	0.130	0.737	7.824	0.005
OHS	0.074	0.0762	-0.075	0.224	0.949	0.330
HPA***	-0.264	0.0699	-0.401	-0.127	14.227	0.000
ORPM**	0.244	0.0888	0.070	0.418	7.523	0.006
PP***	1.140	0.0991	0.945	1.334	132.153	0.000
HRMP	0.056	0.0831	-0.107	0.218	0.446	0.504

Model 5

Likelihood Ratio χ²	df	Sig.				
346.408	6	0.000				
Variable	β	Std. Error	LWCI	UWCI	Wald Chi-Square	Sig.
Intercept	-1.250	0.0662	-1.380	-1.120	357.107	0.000
WD***	0.557	0.1336	0.295	0.819	17.394	0.000
OHS*	0.162	0.0684	0.028	0.296	5.637	0.018
HPA***	-0.240	0.0622	-0.362	-0.118	14.883	0.000
ORPM**	0.251	0.0800	0.095	0.408	9.873	0.002
PP***	0.839	0.0784	0.685	0.993	114.573	0.000
HRMP***	0.384	0.0738	0.239	0.528	26.990	0.000

The implementation of health promotion actions did not affect the occurrence of psycho-social risks related to long and/or irregular working hours, but it contributed at preventing the side effects on individual and collective well-being generated by time pressures ($\beta = -0.35$; significant at the 0.001 level), impaired inter-personal exchanges at work ($\beta = -0.57$; significant at the 0.001 level), interaction with difficult customers ($\beta = -0.29$; significant at the 0.001 level), and irregular working hours ($\beta = -0.30$; significant at the 0.001 level). Surprisingly, prevention measures implemented by organizations were found to have a positive effect on most of the sources of psycho-social stress at work. In particular, such initiatives seemed to determine a greater acknowledgement of time pressures ($\beta = 0.41$; significant at the 0.001 level), poor

relationships with colleagues ($\beta = 0.60$; significant at the 0.001 level), and irregular working hours ($\beta = 0.44$; significant at the 0.001 level). In a quite similar way, the arrangement of policies and procedures to cope with the sources of psycho-social stress at work seemed to pave the way for a greater consciousness of time pressures ($\beta = 0.83$; significant at the 0.001 level), poor relationship at work ($\beta = 0.78$; significant at the 0.001 level), job insecurity ($\beta = 0.47$; significant at the 0.001 level), interaction with difficult customers ($\beta = 1.71$; significant at the 0.001 level), and irregular working hours ($\beta = 0.33$; significant at the 0.001 level) as factors undermining the individual well-being at work. Lastly, yet importantly, the design and the implementation of tailored human resource management practices the address sources of stress in the workplace entailed a greater occurrence of psycho-social risks produced by time pressures ($\beta = 0.45$; significant at the 0.001 level) and by irregular working hours ($\beta = 0.46$; significant at the 0.001 level).

Intriguing insights were collected from the sub-sample of companies operating in the human health services' sector, too. Once again, the digitization of the workplace implied increased risks of psycho-social stress at work. Actually, it triggered greater concerns with time pressures ($\beta = 0.91$; significant at the 0.001 level), impaired interpersonal relationships with colleagues ($\beta = 0.60$; significant at the 0.001 level), job insecurity ($\beta = 0.83$; significant at the 0.001 level), interaction with difficult customers ($\beta = 0.43$; significant at the 0.01 level), and irregular working hours ($\beta = 0.56$; significant at the 0.001 level). The availability of occupational health services was not related to a reduction of psycho-social stress at work. Quite the opposite, it triggered increased acknowledgement of stressors produced by time pressures ($\beta = 0.20$; significant at the 0.01 level), poor relationships at work ($\beta = 0.37$; significant at the 0.001 level), and irregular working hours ($\beta = 0.16$; significant at the 0.05 level).

Health promotion actions seemed to be effective in addressing the sources of psycho-social risks at work. In particular, they reduced worries related to time pressures ($\beta = -0.15$; significant at the 0.05 level), impaired relationships with colleagues ($\beta = -0.25$; significant at the 0.001 level), interaction with difficult customers ($\beta = -0.26$; significant at the 0.001 level), and irregular working hours ($\beta = -0.24$; significant at the 0.001 level). Conversely, organizational prevention measures stimulated a greater awareness of time constraints ($\beta = 0.49$; significant at the 0.001 level), impoverished exchange with peers and supervisors ($\beta = 0.46$; significant at the 0.001 level), interaction with difficult customers ($\beta = 0.24$; significant at the 0.01 level), and irregular working hours ($\beta = 0.25$; significant at the 0.001 level) as originating factors of stress at work.

The arrangement of policies and procedures to enhance the well-being of people and to prevent psycho-social factors of stress turned out to be positively and significantly related to the occurrence of all the sources of strain contemplated in this paper. Actually, it led to a greater acknowledgement of time pressures ($\beta = 0.68$; significant at the 0.001 level), poor relationships with colleagues ($\beta = 0.74$; significant at the 0.001 level), job insecurity ($\beta = 0.18$; significant at the 0.05 level), interaction with difficult customers ($\beta = 1.14$; significant at the 0.001 level), and irregular working hours ($\beta = 0.84$; significant at the 0.001 level) as sources of stress. Last, but not least, the design and the implementation of targeted human resource management practices to cope with psycho-social risks at work was found to generate a greater acknowledgment of time constraints ($\beta = 0.20$; significant at the 0.01 level) and irregular working hours ($\beta = 0.38$; significant at the 0.001 level) as triggers of psycho-social risks at work. However, at the same time it reduced the perception of risks on individual and collective well-being produced by inadequate relationships with colleagues ($\beta = -0.15$; significant at the 0.05 level).

5. Discussion

The research findings should be read in light of the main study limitations. Firstly, the focus of this empirical paper on the education sector and on organizations delivering human health services prevented us from claiming the generalizability of the study results. Secondly, the cross-section nature of this research does not allow us to maintain the causal relationship between workplace digitization, organizational interventions and actions to enhance well-being at work, and perceived psycho-social risks in the workplace. Thirdly, and lastly, it is possible that the research findings were affected by the heterogeneity of cultures and institutional characteristics of the different European countries which were involved in this study.

In spite of these limitations, the evidence collected in this study provided some interesting insights to answer the questions that triggered the empirical research. The digitization of working arrangements and processes lead to a worsening of psycho-social stressors at work both in the education sector and in the human health services' sector. This confirms the side effects brought by the recontextualization of work into the cyber-physical domain (Turel *et al.*, 2019). Digitization of work enacts a pervasiveness of concerns and worries related to the accomplishment of organizational tasks which goes beyond the working sphere and touches the private life: this engenders the perception of greater work-related pressures (Løberg, 2021) and overload (Barley *et al.*, 2011), with negative implications on psycho-social well-being (Akhtar and Moore, 2016). Even though the digitization of work may pave the way for richer and more continuous exchanges across the organization and may bring towards a unification of differences (Bardmann, 2021), it is also expected to disrupt face-to-face exchanges in the workplace (Palumbo, 2021b), with negative implications on both the quality of interpersonal relationships and on the individual and collective ability to accomplish organizational activities (Bregenzer and Jimenez, 2021). This emphasizes the need to account for the improvement of work-related social exchanges, in order to curb the side effects of digitization on psycho-social well-being (Trenerry *et al.*, 2021).

Workplace digitization is also expected to have negative implications on individual perceptions of job security, which is a major source of psycho-social stress at work (Reif *et al.*, 2021). More specifically, the transition towards digitization may reduce the human touch of work, reconceiving people as appendices of technologies (Klimburg-Witjes & Wentland, 2021). Even though the consequent job insecurity can be traded with an increased flexibility of work (Connelly *et al.*, 2021), it is thought to create greater stress, especially amongst those who are less comfortable in interacting with digital tools and ICTs and are more likely to turn disengaged at work (Hauk *et al.*, 2019). Whilst digitization of educational activities did not seem to impair the ability to deal with the evolving expectations of customers, it was found to worsen the psycho-social stressors produced by the perceived difficulty of health services' providers to effectively interact with users in the cyber-physical domain (Faraj *et al.*, 2021). This adds to the stress which is heralded by the reconfiguration of work-related practices and processes triggered by the pervasiveness of digital technologies, endangering the well-being and the emotional stability of employees (Stadin, 2020). Tailored initiatives aimed at preserving the social and relational aspect of health services' design and delivery should be ensured to avoid such side effects on individual psycho-social stress (Bjørn and Østerlund, 2014). Last, but not least, enacting an everywhere and always on work culture (Middleton, 2007), digitization may determine an intensification and an extensification of work (Ahlers, 2016), which has major negative effects on individual psycho-social well-being due to irregular and long working hours (Moore, 2019).

The worsening of psycho-social risks at work perceived by people across the organization produced by digitization may have severe backlash on the quality of services delivered to users (Burke, 2014). From this standpoint, tailored organizational interventions and targeted human resource management practices should be designed and implemented in an attempt to curb the

side effects of digitization on psycho-social well-being at work (Astvik *et al.*, 2014; Martinussen *et al.*, 2017). Health promotion actions intended to make people aware of the importance of healthy living for individual well-being are especially relevant to curb the negative implications of digitization on psycho-social risks at work (Dehkordi *et al.*, 2019). Stimulating people to engage with healthy eating and with physical exercises at work, health promotion actions empower employees and enable them to take positive actions in order to cope with psycho-social stressors at work (Balta *et al.*, 2021). Conversely, the effects of occupational health services' provision were ambiguous. This evidence may be justified by the fact that occupational health services are not understood as a preventive measure to avoid the occurrence or the exacerbation of stressors at work, but at addressing their negative consequences on individual well-being (Palumbo, 2021$_b$). The arrangement of policies and procedures to tackle psycho-social stressors at work and the implementation of organizational initiatives and human resource management practices to enhance the individual and collective well-being seemed to determine a greater awareness of the negative effects of digitization in the workplace (Cazan, 2020). Such an increased awareness is crucial to address the concerns on psycho-social risks at work which are generated by digitization (Badri *et al.*, 2018) and to enact a holistic approach to well-being in the workplace (Hogg, 2017).

Further developments are required to fully shed light on the implications of workplace digitization on psycho-social stressors at work. Firstly, longitudinal research is required in order to check the causality of the relationship between workplace digitization, organizational interventions to promote well-being at work, and psycho-social risks. This would enable us to fully acknowledge the consequences of digitization on time pressures, interpersonal relationships at work, job insecurity, interaction with difficult customers, and irregular working hours, pushing forward what we currently know about its side effects on sources of psycho-social stress at work. Secondly, in-depth qualitative research is needed to obtain a more nuanced and precise account of digitization's effects on working dynamics and processes. This would enable as to better understand how people try to cope with the triggers of psycho-social stress produced by digitization, informing tailored organizational initiatives to promote well-being at work. Finally, yet importantly, comparative studies across different institutional contexts are required to obtain information about how contextual factors – such as institutional dimensions and cultural issues – influence the implications of digitization on psycho-social well-being at work.

6. Conclusions

Workplace digitization was found to endanger the psycho-social well-being at work of employees, paving the way for increased risks of time pressures, poor exchanges with colleagues, job insecurity, and irregular working hours. Moreover, it also impaired the ability of health services' providers to establish good relationships with difficult users, thus generating further sources of work-related stress. Organizations should undertake tailored health promotion actions in order to curb the side effects of digitization on individual and collective working conditions. Moreover, preventive measures and the design of targeted organizational policies are essential to achieve a greater awareness of the special challenges which are related to workplace digitization. In turn, the increased awareness may lead to a greater acknowledgement of the factors which generate psycho-social stress at work, informing initiatives intended to improve the well-being at work of employees.

The study implications are threefold. From a conceptual perspective, it emphasizes that digitization should be handled as a double-edged sword by organization. Its positive implications on organizational efficiency and effectiveness come at cost of work intensification

and extensification. Moreover, digitization involves a recontextualization of relationships with colleagues and relevant stakeholders in the cyber-physical environment, with potential drawback on the meaningfulness of exchanges. Lastly, yet importantly, the pervasiveness of digital tools may reduce the human touch of working arrangements and may make humans feel as appendices of technologies. This greatly affects the perception of individual contribution to organizational performance and increases job insecurity. The combination of these phenomena impair the psycho-social well-being at work at sets the conditions for unhealthy workplaces.

From a policy perspective, the study findings highlight that a precautionary perspective should be taken in designing and implementing interventions intended to foster the digitization of the workplace. Such a precautionary approach should be aimed at assessing the sources of psycho-social stress which are brought by digitization and at inspiring procedures and practices directed to avoid the backlash of digitization on individual and collective well-being at work. Establishing a greater awareness of psycho-social challenges generated by digitization, policy interventions are likely to pave the way for a greater effectiveness in addressing the determinants of stress at work.

Lastly, from a management perspective the research results suggest that health promotion initiatives seem to be more effective than prevention measures in reducing the risks of psycho-social stress at work. Health promotion initiatives directly intervene on the sources of stress at work and enable people to better deal with the intensification and extensification of work which is related to the pervasive use of digital technologies to accomplish organizational activities. From this standpoint, healthy workplace strategies tailored to the specific characteristics of a digital working environment should be designed and implementing, supporting people in developing adequate resources and capabilities to avoid stress and to achieve a sustainable well-being.

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