

Article

Digitalisation, Remote Work, and Perceived Job Security and Quality in Post-COVID-19 Portugal

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Abstract

This study investigates how pandemic-induced digitalisation, understood as the transition to remote work combined with the enforced use of digital tools and the reconfiguration of tasks and digital skills at the job level, has affected job security and job quality in Portugal. In 2022, a nationwide survey was administered to employees in companies registered in the country, yielding 2001 valid responses through a stratified random sampling strategy that ensured representation across different firm sizes. Structural equation modelling (PLS-SEM) was used to examine the relationships between digitalisation (independent construct) and perceived job quality and job security (dependent constructs), while controlling for demographic, organisational, and work-regime characteristics. Digitalisation had a significant positive effect on perceived job quality but no systematic effect on perceived job security. The results also revealed more positive perceptions of job security among women, employees in smaller firms, and those working on-site, whereas directors and workers in the Lisbon Metropolitan Area reported greater negative effects. These findings underscore the importance of contextual factors in shaping how workers experience digitalisation and provide evidence to inform public policies aimed at promoting job security and job quality in a post-COVID-19 labour market.

Keywords: digitalisation; job security; job quality; post-COVID-19 era



Received: 19 January 2026

Revised: 11 February 2026

Accepted: 28 February 2026

Published: 4 March 2026

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1. Introduction

The COVID-19 pandemic accelerated digitalisation, posing challenges for individuals in keeping up with rapid changes. Unemployment surged as organisations navigated disruptions (Gabryelczyk, 2020; Hensher, 2020; Kudyba, 2020). Remote and hybrid work models emerged (World Economic Forum, 2020), increasing unemployment risks in certain industries, while businesses unable to adapt were forced to shut down (F. Almeida & Santos, 2020; Alves et al., 2021; A. S. Lopes et al., 2021). In this study, digitalisation is understood in a specific and empirically grounded way, referring to the pandemic induced reconfiguration of work at the job level, which combined the transition to remote work, the enforced use of digital tools, and changes in tasks and digital

skills as experienced by employees. Rather than capturing the full breadth of digital transformation and automation, this operationalisation focuses on a specific contextual experience of digital work arrangements under COVID 19 conditions. As such, the scope of our findings is limited to this form of job level digitalisation and should not be generalised to all dimensions of digital transformation in the labour market. Beyond immediate impacts, the pandemic brought lasting transformations to the labour market (Sequeira et al., 2020). Remote work led to role changes within organisations (F. Almeida & Monteiro, 2020), while individuals and families faced mental health challenges due to these shifts (Vieira & Meirinhos, 2021). Emerging technologies accelerate entrepreneurship (Modgil et al., 2022; Scarlat et al., 2022) but also pose psychological challenges, including nostalgia, declines in well-being and productivity, and shifts in work–life balance, affecting the future of work (Amankwah-Amoah et al., 2021; Kutnjak, 2021). The pandemic gave employers direct insight into remote work’s pros and cons, helping shape future business strategies (Labour Relations Agency, 2020; NI Business Info, n.d.). Sociological critiques highlight concerns over control, surveillance, and resistance in employment (Hodder, 2020). Remote work may not suit everyone, as it can lead to feelings of disconnection from colleagues and the organisation, which office environments naturally mitigate (Moretti et al., 2020; Okuyan & Begen, 2022). Workplace flexibility, home office conditions, and organisational support are crucial for improving productivity, satisfaction, work–life balance, and commitment (Bouziri et al., 2020; Mehta, 2021; Yang et al., 2023).

The International Labor Organization (ILO) urged large-scale measures, including social protection, job retention support, and financial and tax benefits for businesses of all sizes. Proposed policies also included fiscal and monetary actions, loans, and sector-specific financial aid (Ryder, 2020). The COVID-19 pandemic’s economic and social crisis accelerated digitalisation and hybrid work, reshaping sectors and workforce dynamics. Many workers transitioned to remote or mixed arrangements supported by digital tools, experiencing concrete changes in how and where work was performed. Assessing short-term impacts over two years is key to understanding job quality and stability, as some sectors face greater vulnerability. Organisational factors, such as size and public or private status, play a crucial role in adaptation outcomes.

Certain social groups, defined by factors like age, gender, contract type, and job position, are more vulnerable to economic impacts from pandemic-related organisational strategies (F. Almeida et al., 2022; F. Almeida & Santos, 2020). Portugal’s territorial disparities, particularly in major cities like Lisbon and Porto, influence worker localisation and job dynamics (P. P. Santos & Ferreira, 2023). The lack of physical interaction heightened financial struggles in sectors dependent on in-person presence, such as tourism and leisure, while also generating new industry opportunities (Achim et al., 2022; Alves et al., 2021; Gomes et al., 2022; A. S. Lopes & Carreira, 2022; J. Lopes & Oliveira, 2022; A. S. Lopes et al., 2021; E. Santos & Castanho, 2022).

In Portugal, a research gap persists in comparing pre- and post-COVID-19 work dynamics beyond two years. Existing studies often focus on the immediate effects of confinement and job restructuring, rather than on how workers perceive digitalisation processes centred on remote work and digital tools in the medium term. This study aims to inform public policies on digitalisation and work transformation, understood here as interconnected phenomena that have significantly evolved during and after the pandemic.

- Do digitalisation processes in Portugal, as experienced through the transition to remote work and digitally mediated work arrangements, have distinct effects on work quality and job security for workers based on their social characteristics and organisational attributes?

- How can these differentiated short-term effects inform social policies aimed at shaping future work and jobs?

This study aims to answer these research questions using empirical data and self-reported perceptions gathered from the working population of Portugal, comparing periods before and after COVID-19. Additionally, it aims to provide a systematic presentation of the effects of digitalisation processes, operationalised through changes in work arrangements and digital tools, on Portugal's workforce, addressing a critical need for comprehensive understanding. The results obtained are crucial for consolidating public policies based on concrete data regarding economic, social, sectoral, and territorial vulnerabilities that require intervention. This approach aims to foster a sustainable, human-centred economic recovery prioritising employment, income, social protection, workers' rights, and social dialogue.

2. Theoretical Framework

Digitalisation is often described as a broad technological and organisational transformation that reshapes production systems, business models, and labour markets. In the context of this study, however, digitalisation is conceptualised in a narrower and more empirically grounded way, capturing the specific reconfiguration of work arrangements induced by the COVID-19 pandemic at the workplace level. More precisely, digitalisation refers here to the combination of transitioning to remote work, adopting or intensifying the use of information technologies, and changing tasks and roles in ways that require the development of new digital skills, as operationalised by dimensions "Change to Remote work" and "Change to remote work + Change to a new function + Start IT + IT skills development" (indicators P26b–P28 in the survey). This conceptualisation aligns the theoretical discussion with the empirical measurement strategy and focuses the analysis on how pandemic-driven digital work arrangements affect employees' perceptions of job quality and job security. This narrower, empirically grounded conceptualisation explicitly departs from broader accounts of digital transformation and automation, and the interpretation of our results is therefore confined to digitally mediated work arrangements triggered by the pandemic, rather than to long term technological substitution or automation processes.

Barros (2021) demonstrated that telework has enhanced viability, productivity, and flexibility for employees. For example, it has reduced travel costs and enabled employers to hire talented individuals for home-based roles across different locations and countries.

Complementing this view, Grave et al. (2025), in a Portuguese case study, highlight that flexibility has become a decisive factor in workers' perceptions of telework after the pandemic, although gender inequalities persist in the distribution of domestic and care tasks. Perelman et al. (2024) further show that adequate ergonomic conditions, effective time management, and organisational support are critical for health and productivity in remote work arrangements.

In terms of social implications, Heredia et al. (2022) highlighted the importance of firms' digital capabilities during the COVID-19 pandemic in facilitating the transition to a "new normal." Moreover, their study underscores the positive effect of digital capabilities in countries with a low Human Development Index (HDI)—a measure used by the United Nations to assess key dimensions of human development. Similar results are found in Luca et al. (2025), who examined the new geography of remote jobs in Europe, showing that access to telework is uneven across sectors and regions, raising questions of digital inclusion. As Kryzhanovskij et al. (2021) argue, digitalisation at the firm level can create opportunities for growth, enhance quality of life, promote human development, and improve the quality of employment.

Regarding mental health, [Barros \(2021\)](#) emphasises the importance of respecting workers' rights and fostering social coexistence, particularly through the right to disconnect, achieving a work–life balance, and thereby improving employees' life and job quality.

In line with this perspective, [Rebelo et al. \(2024\)](#), in an exploratory study in Portugal, demonstrate that women in particular value this right as a safeguard against work intensification and burnout. [A. R. Almeida et al. \(2025\)](#) also warns of new psychosocial risks in hybrid work contexts, such as intensive digital monitoring and constant availability demands, which can lead to burnout.

Meanwhile, [Rodriguez-Bustelo et al. \(2020\)](#) note that research predicts a decline in overall demand for labour and wages, alongside qualitative shifts in the labour market ([Acemoglu & Restrepo, 2018](#)). These changes could result in a skills mismatch between the workforce's existing capabilities and future job requirements.

While some changes brought by the digital revolution will undoubtedly improve our lives, and its effect on work and employment remains a topic of debate, companies are increasingly adapting to the “new normal” by reshaping their activities, strategies, and routines ([Heredia et al., 2022](#); [Loureiro et al., 2021](#)). Many organisations have embraced digital tools to optimise processes and improve efficiency, ensuring business continuity, and digital capabilities are gaining prominence responding to an ever-changing and turbulent environment ([Zhen et al., 2021](#)).

Rising unemployment and growing wealth inequality pose challenges for governments, businesses, and individuals in leveraging digital transformation benefits ([Makridakis, 2017](#)). Increasing longevity and rapid technological innovation will reshape future work, creating policy and societal challenges ([Lewis, 2020](#)). Despite fears of automation, workers show little effect on their preparation for these transitions ([Rodriguez-Bustelo et al., 2020](#)).

[Smith and Anderson \(2014\)](#) had already indicated the risk of obsolescence in administrative and customer service roles, while [Dengler and Matthes \(2018\)](#) estimate that nearly half of current jobs in advanced economies could be automated within 10 to 20 years.

In the European context, [Richiardi et al. \(2025\)](#) show that digitalisation has reshaped employment and wage dynamics, with significant implications for inequality. [Ho et al. \(2025\)](#) reinforce that digitalisation, when not accompanied by inclusive policies, can exacerbate income disparities. [Marguerit \(2025\)](#) further differentiates the effects of artificial intelligence technologies that augment productivity from those that replace labour, revealing heterogeneous effects depending on the type of occupation. At the same time, [Eurofound \(2024\)](#) warns about the negative effects of telework on work intensification, increased anxiety, and blurred boundaries between work and personal life.

Together, these studies indicate that digitalisation and telework simultaneously offer opportunities and risks: they can promote flexibility, productivity, and inclusion, but they can also intensify inequalities, generate mental health risks, and create scenarios of job obsolescence.

Hypothesis

Considering digitalisation as the pandemic-induced reconfiguration of work arrangements at the job level, this study examines its implications for job quality and job security in Portugal. By focusing on changes such as the shift to remote work, the enforced use of digital tools, and the reassignment of tasks that required developing new IT skills, the analysis captures how workers experienced digitalisation in their daily work between 2020 and 2022. Drawing on prior research showing that digitalisation and telework can simultaneously create opportunities and risks for workers, the model tests whether this form of digitalisation has a direct effect on perceived job quality and on perceived job

security. Accordingly, two hypotheses are formulated: H1 posits that digitalisation has a direct effect on job quality, and H2 posits that digitalisation has a direct effect on job security (see Table 1).

Table 1. Hypothesis formulation.

Hypothesis	Relationships	References
H ₁	Digitalisation has a direct effect on Job Quality	Barros (2021); Rodríguez-Bustelo et al. (2020); Heredia et al. (2022)
H ₂	Digitalisation has a direct effect on Job Security	Heredia et al. (2022); Rodríguez-Bustelo et al. (2020)

Source: own elaboration.

3. Materials and Methods

3.1. Constructs Modelling

3.1.1. Definition of Constructs and Indicators

Structured models were used to study this effect. To control for potential effects, some variables describing the company profile and employees' social characteristics were included into the models as control variables.

To contrast the above hypotheses, hypothesis 1 and hypothesis 2, three constructs were created: Digitalisation (as an exogenous construct, i.e., serving only as an independent variable in the structural model), Job Quality, and Job Security (as endogenous constructs serving as dependent variables in the structural model).

Digitalisation was described in three dimensions, each of which was measured by an indicator: (1) change to remote work (P26b); (2) switch to remote working and start using IT (by indication of the company and caused by the COVID-19 pandemic) (P27); (3) change to remote working and change to a new function (possibility of integration); and Start IT and development of IT skills (by indication of the company and caused by the pandemic) (P28). It is important to emphasise that in constructing the indicators, we tried to ensure that there were no sub-groups in the answers to these indicators. These three dimensions are understood as an index of "digital work reconfiguration" at the workplace level, which empirically operationalises the notion of digitalisation as experienced by workers during the pandemic.

The perception of Job Quality was described by four dimensions, each measured by an indicator: (1) change in perception of wage; (2) change in perception of social care (SC); (3) change in perception of social environment (SE); (4) change in perception of mental health (MH). Since it is intended to verify the effect of COVID-19 pandemic on the perception of these 4 dimensions of Job Quality, "difference variables" were created to measure the variation between the post- and pre-pandemic perception averages. For example, to verify whether Digitalisation, through the COVID-19 pandemic, had a positive effect on wage perception, the variable difference WG_DIF44 (=WG_pos – WG_pre) was created, whose value 1—"Yes" reveals a positive or null difference between the post- and pre-pandemic wage perception averages, and the value 2—"No" evidences a negative difference between post- and pre-pandemic wage perceptions averages, which may mean a negative effect, i.e., that Digitalisation has worsened the wage perception. In this coding, "yes" combines stable and improved perceptions, whereas "no" indicates deterioration between the pre and post pandemic periods. This binary specification treats no change and positive change as theoretically equivalent in that both signal non deterioration of job quality, which is the key contrast of interest in the context of a major crisis. Taken together, these seven binary indicators form a formative index that primarily reflects employment continuity and protec-

tion from adverse changes (e.g., job loss, wage cuts, contract downgrades) over the period March 2020–March 2022. Conceptually, this dimension is closer to objective job security than to subjective job insecurity, which typically refers to perceived risk or fear of future job loss. We return to this distinction in the Discussion when interpreting the absence of a robust direct effect of digitalisation on this construct.

The perception of Job Security was described by seven dimensions, each measured by one indicator: (1) no job loss; (2) no job change; (3) no job instability; (4) no wage decrease; (5) no lack of job status progression (in the sense of no lack of career development); (6) no change of contract type; and (7) no lay-off experience. For example, a response 2—“No” for the indicator measuring the dimension “no job instability” indicates that this respondent has experienced 2 or more job changes in the period from March 2020 to March 2022, i.e., it represents instability.

Control variables were also considered to describe the company profile: sector of activity, size and location; and the social characteristics of the employees: employee age, gender, level of education, position, and work regime (post-COVID-19). Table 2 describes the constructs and indicators.

Table 2. Definition of constructs and indicators.

Constructs	Dimensions	Indicators	Scale	Support
Digitalisation	Change to remote work	P26b.	1—“Yes” 2—“No”	Barros (2021); Heredia et al. (2022)
	Change to remote work + Start IT	P27.		Rodriguez-Bustelo et al. (2020); Barros (2021)
	Change to remote work + Change to a new function + Start IT + IT skills development	P28.		Heredia et al. (2022); Rodriguez-Bustelo et al. (2020); Ryder (2021);
Job Quality (perception)	Change on wage	WG_DIF44	1—“Yes” 2—“No”	Rodriguez-Bustelo et al. (2020); Ryder (2020);
	Change on social care	SC_DIF22		Ryder (2020)
	Change on social environment	SE_DIF55		
	Change on mental health	MH_DIF33		
Job Security (perception)	No job loss	P15a	1—“Yes” 2—“No”	Barros (2021); Ryder (2020)
	No change of job	P16a		Ryder (2020)
	No job instability	P17b		Ryder (2020)
	No wage decreased	P19b		Barros (2021); Ryder (2020)
	No lack of status progression	P20b.		
	No change of type of contract	P22b		
	No lay-off experience	P14a		Barros (2021)
Control variables	Company Profile		1—Primary sector 2—Secondary sector 3—Tertiary sector 4—Others	PORDATA (n.d.) ¹
	Activity sector	P8_r		
		Company size (n. of employees)	P7	1—Micro company (<10 employees) 2—Small company (10–49 employees) 3—Medium company (50–249 employees) 4—Large company (≥250 employees)

Table 2. Cont.

Constructs	Dimensions	Indicators	Scale	Support
Control variables	Company location	P6_r	1—Alentejo 2—Algarve 3—Área Metropolitana de Lisboa 4—Centro 5—Norte 6—Regiões Autónomas	PORDATA (2013) ²
	Employees' Social Characteristics			
	Employee age	F1	Continuous	
	Gender	P1	1—"Male" 2—"Female" 3—"Other"	
	Education level	P3_r	2—Primary and lower Secondary (≥9 years) 3—Upper secondary (≥12 years) 4—Higher	Rodriguez-Bustelo et al. (2020)
	Position	P9_r	1—Director 2—Direct boss/supervisor 3—Professional with high autonomy, but no leadership position 4—Performing worker	Rodriguez-Bustelo et al. (2020)
	Work regime (Post-COVID-19)	P13	1—Presential 2—Distance/teleworking 3—Mixed	

Source: Own elaboration. ¹ PORDATA mentions the primary, secondary, tertiary, and other sectors of activity, but offers detailed information using categories (<https://www.pordata.pt/censos/resultados/emdestaque-portugal-1075>, accessed on 26 June 2023). ² Data published in PORDATA are according to the 2013 version of the Nomenclature of Territorial Units for Statistics (NUTS). In this paper the NUTS II categorisation was used.

3.1.2. Methodology and Data Collection

This study employed a quantitative methodology based on a nationwide geographical survey. The target population comprised employees working in companies registered in Portugal. A stratified random sampling technique was used to ensure homogeneous representation across four organisation sizes, addressing the limitations of simple random sampling. This approach enhances data homogeneity within strata, reduces data collection and analysis costs, and allows for separate parameter estimates by firm size without additional sampling effort.

A telephone survey conducted in the first half of 2022 collected responses to 76 original questions from 2001 employees. The questionnaire aimed to capture perceived changes in job security and job quality before and two years after the onset of the pandemic. Although telephone interviews facilitate nationwide coverage and higher response rates, they may also increase the risk of social desirability bias, which should be considered when interpreting self-reported perceptions.

Structural equation modelling (SEM) was used to examine the relationships among the constructs, combining factor-analytic and regression components to model latent variables and account for measurement error. A variance-based partial least squares approach (PLS-SEM) was chosen because it accommodates complex models with both formative and reflective constructs, handles multicollinearity and non-normal indicators, and is suitable for

exploratory research with self-designed instruments and limited prior theory (Chin, 2010; Rigdon, 2016; Sarstedt et al., 2011, 2019). Although PLS-SEM is often discussed in the context of smaller samples, it is also appropriate for larger datasets when the primary objective is prediction and theory development rather than strict covariance-based model fit.

Digitalisation and job security were modelled as formative constructs, where the indicators represent distinct facets that jointly define the latent variable and are not expected to be interchangeable. In this specification, causality flows from the indicators to the construct, which was estimated using Mode B in PLS-SEM (Hair et al., 2022). Job quality was specified as a reflective construct, where the indicators are manifestations of an underlying latent dimension and are expected to covary; in this case, causality flows from the construct to the indicators, and the measurement model was estimated using Mode A (Henseler & Schuberth, 2020).

The model was estimated with SmartPLS 4, which supports binary and categorical indicators as well as complex path models (Ringle & Sarstedt, 2016). The analysis included model fitting and bootstrapping with 10,000 subsamples for inference, complemented by exact fit tests (Henseler et al., 2016b) and saturation fit analysis (Müller et al., 2018). Path coefficients were evaluated in terms of sign, magnitude, and statistical significance, alongside additional quality criteria such as reliability and convergent validity where applicable (Ali et al., 2018; Hair et al., 2022).

4. Results

4.1. Sample Characterisation

Most respondents were aged 25–44, followed by 45–54, reflecting the typical age distribution of employees in Portugal. Secondary or post-secondary education was the most common qualification, and manufacturing industries predominated among sectors of activity. The respondents' profile is summarised in Table 3.

Table 3. Respondents' profile.

Variable	Category	N (%)
Gender	Women	995 (49.7%)
	Men	1006 (50.3%)
Age	18–24	110 (5.5%)
	25–44	913 (45.6%)
	45–54	552 (27.6%)
	55–64	358 (17.9%)
	65 or more	68 (3.4%)
Education level	1st elementary school cycle	164 (8.2%)
	2nd elementary school cycle	222 (11.1%)
	3rd elementary school cycle	392 (19.6%)
	Secondary and post-secondary	600 (30.0%)
	Higher education (bachelor or licentiate)	385 (19.2%)
	Higher education (master's)	206 (10.3%)
	Higher education (doctorate)	32 (1.6%)
Sector of activity	Extractive industries	8 (0.4%)
	Real estate activities	18 (0.9%)
	Electricity, gas and water	26 (1.3%)
	Financial and insurance activities	42 (2.1%)
	Agriculture, livestock, hunting, forestry, and fishing	56 (2.8%)
	Transportation and storage	90 (4.5%)
	Lodging, restaurant, and similar activities	124 (6.2%)
	Construction	126 (6.3%)
	Education	180 (9.0%)
	Human health and social support activities	204 (10.2%)
	Wholesale and retail trade	286 (14.3%)
	Manufacturing industries	350 (17.5%)
	Other sectors	491 (24.5%)

Source: Own elaboration.

Control variables captured firm/employee profiles (in Table 4), and a multi-group analysis by company size was performed.

Table 4. Control variables.

Control Variables	Indicators	Category	N (Valid %)
Company profile	Activity sector (P8_r)	1—Primary sector	56 (2.8%)
		2—Secondary sector	510 (25.5%)
		3—Tertiary sector	944 (47.2%)
		4—Others	491 (24.5%)
	Company size (P7)	1—Micro company (<10 employees)	374 (18.7%)
		2—Small company (10–49 employees)	445 (22.2%)
		3—Medium company (50–249 employees)	462 (23.1%)
		4—Large company (≥250 employees)	720 (36.0%)
	Company location (P6_r)	1—Alentejo	136 (6.8%)
		2—Algarve	94 (4.7%)
		3—Área Metropolitana de Lisboa	636 (31.8%)
		4—Centro	501 (25.0%)
		5—Norte	634 (31.7%)
Employees' social characteristics	Age (F1)	Continuous	43.4 ± 11.6
	Gender (P1)	1—"Male"	1006 (50.3%)
		2—"Female"	995 (49.7%)
	Education level (P3_r)	2—Primary & lower secondary (≤9 yrs)	778 (38.9%)
		3—Upper secondary (≤12 yrs)	600 (30.0%)
		4—Higher	623 (31.1%)
	Position (P9_r)	1—Director	119 (5.9%)
		2—Direct boss/supervisor	233 (11.6%)
		3—Professional with autonomy but no leadership	590 (29.5%)
		4—Performing worker	1059 (52.9%)
	Work regime (Post-COVID-19) (P13)	1—Presential	1710 (85.5%)
		2—Distance/teleworking	67 (3.3%)
		3—Mixed	224 (11.2%)

4.2. Indicators Descriptive Statistics

A summary statistics analysis of all indicators is presented in Table 5.

Table 5. Summary statistics analysis.

Constructs	Dimensions (Indicators)	Yes N (Valid %)
Digitalisation	Change to remote work (P26b)	191 (10.7%)
	Change to remote work + Start IT (P27)	343 (19.2%)
	Change to remote work + Change to a new function + Start IT + IT skills development (P28)	41 (15.2%)
Job Quality (perception)	Change on wage (WG_DIF44)	1379 (75.2%)
	Change on social care (SC_DIF22)	1547 (84.4%)
	Change on social environment (SE_DIF55)	1500 (81.8%)
	Change on mental health (MH_DIF33)	1202 (65.6%)
Job Security (perception)	No job loss (P15a)	1851 (92.5%)
	No change of job (P16a)	1714 (85.7%)
	No job instability (P17b)	213 (74.2%)
	No wage decreased (P19b)	1851 (92.5%)
	No lack of status progression (P20b)	342 (17.1%)
	No change of type of contract (P22b)	67 (42.7%)
	No lay-off experience (P14a)	1590 (79.5%)

Notably, 37% reported improved wage perceptions, while 7.5% indicated a decline. This could reflect the fact that all respondents were employed and not self-employed (F3: N = 2001; 100%).

4.3. PLS-SEM Results

4.3.1. Model Robustness Analysis

Measurement Model

The analysis started with the construction and assessment of Model 1, which contains all the indicators described in Table 2. For the reflective construct (Job Quality), the assessment began by inspecting indicator loadings. An outer loading of 0.372 was observed for SE_DIF55; according to the literature, indicators with very low loadings (below 0.40) should be eliminated from the measurement model (Hair et al., 2022). Therefore, SE_DIF55 was removed in Model 2. It is common to obtain weaker loadings (<0.708) in social science studies, especially when newly developed scales are used (Hulland, 1999).

For the formative constructs Digitalisation and Job Security, the indicators P28, P16a, and P22b were removed in Model 2 due to low and/or negative weights. We recognise that this decision narrows the substantive meaning of the indices, particularly for Job Security, and therefore interpret the constructs as broad approximations of job level digital work reconfiguration and continuity-oriented job security. As a robustness check, we estimated alternative specifications retaining these indicators (reported in Appendix A); the main structural results—including the significant effect of Digitalisation on Job Quality and the non-significant direct effect on Job Security in the full model—remained substantively unchanged. Other indicators with weaker weights were retained because their exclusion would have harmed content validity and construct representation (Hair et al., 2022). The removal of SE_DIF55, P28, P16a, and P22b was thus based on both statistical criteria and the need to preserve the conceptual coverage of the formative indices.

Indicators with loadings between 0.40 and 0.708 were considered for removal only when their deletion increased internal consistency reliability or convergent validity above threshold values. From Model 1 to Model 2, composite reliability (ρ_c) for Job Quality increased from 0.638 to 0.651, and AVE improved from 0.315 to 0.389. Although internal consistency reliability is ideally above 0.70, values between 0.60 and 0.70 are acceptable in exploratory research using new measures (Hair et al., 2022). Given that there is only one reflective construct, discriminant validity tests are not applicable.

To assess construct validity for the formative measures, indicator weights were examined to evaluate each indicator's contribution to the variance of the latent variable. Table 6 presents outer loadings, outer weights, construct reliability, and collinearity diagnostics for Model 1 and Model 2. The item weights showed that P26b and P20b explained a substantial share of the variance of Digitalisation and Job Security, respectively, while some indicators (e.g., P15a, P17b, P19b) had non-significant weights, indicating a weaker contribution and reinforcing the view that these indices should be interpreted as broad approximations of the underlying constructs. These borderline values were partly a consequence of the binary difference specification and the limited number of indicators, which compressed variability in perceived job quality. Rather than indicating a deficient construct, they reflect the challenging nature of capturing crisis related changes with coarse, retrospective measures and reinforce the exploratory status of our scale (Table 6).

Collinearity statistics (VIF) for the formative constructs were below 2.5 in Model 2 and lower than in Model 1, indicating no critical multicollinearity problems (Figure 1).

Table 6. Measurement model—outer loadings, outer weights, construct reliability, and discriminant validity.

	Model 1	Model 2
Reflective construct—Outer loadings		
MH_DIF33 $\leftarrow$ Quality	0.707	0.729
SC_DIF22 $\leftarrow$ Quality	0.583	0.619
SE_DIF55 $\leftarrow$ Quality	0.372	/
WG_DIF44 $\leftarrow$ Quality	0.532	0.502
Composite reliability (rho_c)	0.638	0.651
Average variance extracted (AVE)	0.315	0.389
Formative construct—Outer weights		
P14a $\rightarrow$ Security	0.481	0.482
P15a $\rightarrow$ Security	0.135	0.002
P16a $\rightarrow$ Security	−0.348	/
P17b $\rightarrow$ Security	0.151	0.141
P19b $\rightarrow$ Security	0.234	0.246
P20b $\rightarrow$ Security	0.651	0.786
P22b $\rightarrow$ Security	−0.259	/
P26b $\rightarrow$ Digitalisation	0.888	0.800
P27 $\rightarrow$ Digitalisation	0.207	0.393
P28 $\rightarrow$ Digitalisation	−0.227	/
Collinearity statistics (VIF)	<1.340	<1.122

Source: Own elaboration.

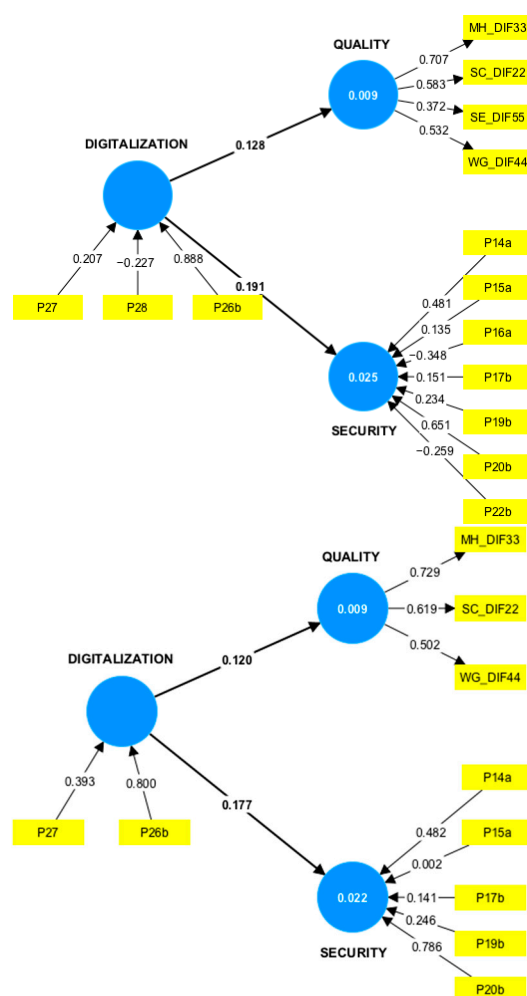
**Figure 1.** Model 1 (with all the indicators); Model 2 (validated).

Figure 1 shows the path diagrams for Model 1 and Model 2. Both measurement (outer-model) and structural (inner-model) path coefficients varied from 0 to plus or minus 1, with paths with coefficients closest to absolute 1 being the strongest.

Structural Model

To assess the statistical significance of the path coefficients in Model 2, bootstrapping (10,000 resamples, bias-corrected and accelerated, two-tailed, significance level 0.05) was applied to obtain *t*-statistics and *p*-values (Hair et al., 2022; Heredia et al., 2022). Figure 2 displays the bootstrapping results.

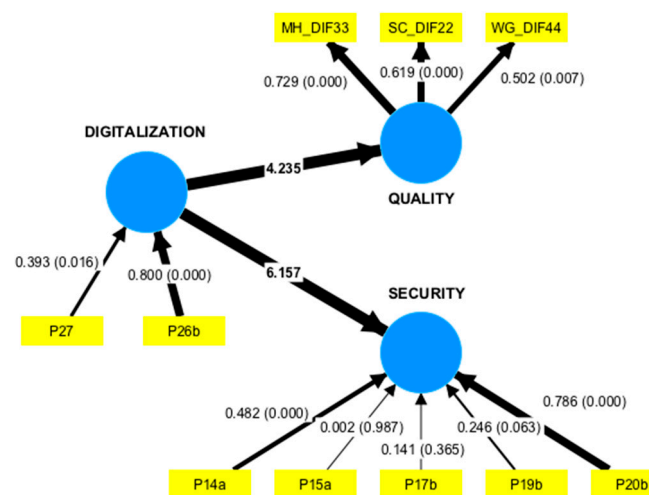


Figure 2. Model 2—bootstrapping results (0.05; 2-tailed); showing the *t*-values for inner-model; the outer weights/loadings and *p*-values (between parenthesis) for outer-model.

In the baseline model without control variables, both paths from Digitalisation to Job Quality and to Job Security were statistically significant at the 5% level ($p < 0.05$; *t*-statistics > 1.96 , two-tailed), indicating that Digitalisation was initially associated with both outcomes. However, when control variables were introduced (see Section 4.3.2 and Table 7), only the effect on Job Quality (H1) remained significant in the full model, whereas the effect on Job Security (H2) was no longer statistically significant.

Table 7. Bootstrapping results in model.

	Sample Mean	Std. Deviation	<i>p</i> -Value
Gender → Security	0.033	0.016	0.037
Location2 → Security	0.119	0.047	0.012
Location4 → Security	0.054	0.023	0.016
Location5 → Security	0.055	0.023	0.015
Position1 → Security	−0.075	0.029	0.010
Regime2 → Security	−0.193	0.053	0.000
Regime3 → Security	−0.085	0.034	0.014
Size1 → Security	0.135	0.023	0.000
Size2 → Security	0.059	0.023	0.010
Size3 → Security	0.046	0.022	0.034

Source: Own elaboration.

Regarding the outer model, most outer weights/loadings were significant, with the exception of some formative indicators for Job Security (P15a, P17b, P19b), which had non-significant weights ($p > 0.05$) and therefore contributed less to the construct's variance. For both the measurement and structural models, SRMR values were below 0.10. The saturated (measurement) model had an SRMR of 0.071, and the estimated (structural) model an

SRMR of 0.072. Although global fit indices should be interpreted cautiously in PLS-SEM, values below 0.10, or below 0.08 in more conservative criteria (Hu & Bentler, 1998), are usually considered acceptable (Henseler et al., 2016b; Ringle et al., 2022).

4.3.2. Model with Control Variables Analysis

Control variables describing the firm's profile (sector, size, location) and employee characteristics (age, gender, education level, work regime, position) were included in the model. For multi-categorical variables, dummy variables were created with the most frequent category as the reference. The bootstrapping results in the model (10,000 resamples, bias corrected, two-tailed tests, significance level 0.05) are shown in Table 7.

According to these results, none of the control variables had a statistically significant effect (at the 5% level) on the Job Quality construct when compared with its reference category, which is consistent with the descriptive evidence that perceived improvements in job quality are widespread across groups. In contrast, several controls had significant effects on Job Security. Being female had a statistically significant positive effect on Job Security compared with being male, indicating that employed women were more likely to report job security than employed men during the pandemic. Company location in the Algarve, Centre, or North had a statistically significant positive effect on Job Security compared with the Lisbon Metropolitan Area. The position of director had a statistically significant negative effect compared with performing workers, meaning that directors experience greater negative effects on perceived job security. Distance/teleworking and mixed regimes had statistically significant negative effects relative to the presential regime, indicating that employees working post-COVID-19 in remote or mixed arrangements felt a greater negative effect of the pandemic on their job security than those working face-to-face. Finally, micro, small, and medium enterprises had statistically significant positive effects on Job Security compared with large enterprises, suggesting that employees in smaller companies feel more secure in their jobs and report less negative effect on workplace security.

Regarding the structural hypotheses, Table 8 summarises the results for H1 and H2 in the full model including control variables. Only H1 (Digitalisation → Job Quality) was supported ($p < 0.001$), while H2 (Digitalisation → Job Security) was not statistically significant ($p = 0.352$), indicating that digitalisation had no robust direct effect on perceived job security once structural factors and work arrangements were taken into account.

Table 8. Results for hypothesis supporting.

Hypothesis	Std Coefficient	<i>p</i> -Value	Supported
H ₁ : Digitalisation → Job Quality	0.117 (0.026)	0.000	Yes
H ₂ : Digitalisation → Job Security	0.033 (0.034)	0.352	No

Standardised coefficient is represented by: sample mean (standard deviation). Source: own elaboration.

Figure 3 shows the structural model results after bootstrapping: 10,000 resamples, bias-corrected, two-tailed, level of significance 0.05. It presents inner-model (path coefficients and *p*-values) and outer-model (R^2 and *p*-values).

The R^2 values observed were 0.110 (Digitalisation → Quality) and 0.032 (Digitalisation → Security). Low R^2 values do not invalidate the model in PLS-SEM when the focus is on theoretical exploration and analysis of structural relationships, rather than prediction (Hair et al., 2022; Henseler et al., 2016a).

These values may indicate that the construct is influenced by variables external to the model, which is common in social studies.

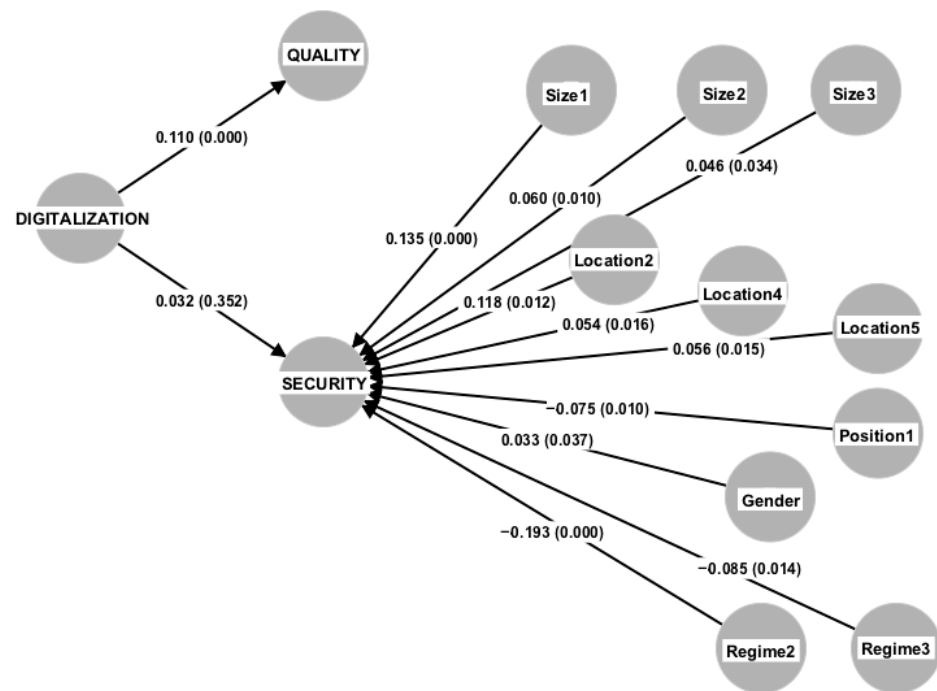


Figure 3. Structural model results. Source: own elaboration.

The use of PLS-SEM is justified by the exploratory nature of the study and the complexity inherent in the phenomena analysed in the social sciences. Although the R^2 values of the endogenous constructs were modest, this result is consistent with the literature, which recognises that social behaviours and attitudes are influenced by multiple factors external to the model. Furthermore, PLS-SEM is particularly suitable for data from telephone interviews, due to its robustness to non-normal distributions and higher levels of measurement error, allowing the analysis of structural relationships even in empirical contexts with high variability.

A multi-group analysis based on company size was also conducted. Comparing the path coefficients for the group of large enterprises (S4) with those for micro (S1), small (S2), and medium (S3) firms, no statistically significant differences in path coefficients were detected (p -values > 0.05), indicating that the effects of Digitalisation on Job Quality and Job Security did not differ significantly across size groups when large enterprises were used as the reference.

The results of the bootstrapping-based multi-group analysis are shown in Table 9, indicating the hypothesis tested for each group as H_1 , and H_2 , sample mean for each group, and the estimation results on group level (p -values).

Table 9. Bootstrapping-based multigroup analysis results on the company size.

	Original				Sample Mean				p -Value			
	S1	S2	S3	S4	S1	S2	S3	S4	S1	S2	S3	S4
H_1 : Digitalis. $\rightarrow$ Quality	0.047	0.197	0.094	0.151	0.018	0.222	0.132	0.163	0.799	0.000	0.240	0.002
H_2 : Digitalis. $\rightarrow$ Security	0.280	0.110	0.203	0.136	0.323	0.133	0.215	0.142	0.010	0.241	0.005	0.013

Group categories: Micro companies (S1); small companies (S2); medium companies (S3); large companies (S4). Source: Own elaboration.

However, the group-level estimates revealed that some paths were significant within specific firm-size strata. Digitalisation had a significant positive effect on Job Quality in small companies (S2) and large enterprises (S4), and a significant effect on Job Security in

micro companies (S1), medium companies (S3), and large enterprises (S4). These subgroup results should be interpreted with caution, as they are based on stratified samples and do not alter the overall conclusion that, in the full model with controls, only H1 was consistently supported, while H2 was not confirmed at the 5% level.

5. Discussion

5.1. H1: Digitalisation → Job Quality

The model shows a positive and statistically significant effect of digitalisation on perceived job quality, indicating that pandemic-induced reconfiguration of work—combining transitions to remote work, enforced use of digital tools, and changes in tasks and digital skills—was associated with more favourable evaluations of several dimensions of job quality. In particular, a majority of respondents reported positive changes in wages (75.2%), social care (84.4%), social environment (81.8%), and mental health (65.6%) between the pre- and post-pandemic periods.

These perceptions are consistent with national and European evidence. [Eurofound \(2024\)](#) notes that nominal wages increased in 2021, even though real gains were later eroded by inflation, while sector-specific data, such as a 4.4% nominal wage increase for contact-centre operators, coexist with a subsequent decline in teleworking and hybrid arrangements in that sector ([ECO News, 2025](#)). At the same time, studies report that organisations implemented measures to support employees and reduce social isolation during telework, in line with favourable perceptions of social care ([Koch, 2022](#)), and that many workers evaluated new digital work arrangements positively, reinforcing the positive changes in social environment ([F. Almeida et al., 2020](#)). Research on telework further shows that when such arrangements are perceived as beneficial, they are associated with better psychological well-being and lower levels of anxiety, depression, and burnout, supporting the observed improvements in perceived mental health ([Faustino et al., 2023](#)). Taken together, these findings support H1 by showing that digitalisation, as experienced through new work arrangements and digital tools, contributed to enhanced perceived job quality in the short term.

5.2. H2: Digitalisation → Job Security

By contrast, the direct path from digitalisation to perceived job security is not robustly supported in the model, suggesting that short-term employment stability was influenced more by institutional protection and structural conditions than by digital reorganisation of work alone. Portugal experienced a relatively low share of job losses during the pandemic (7.5%), largely due to government support measures such as credit lines for firms, progressive recovery schemes, and employment protection policies embedded in the Recovery and Resilience Plan, which helped maintain productive capacity and protect jobs ([European Commission, n.d.](#); [Barros, 2021](#)). The lay-off regime, experienced by 20.5% of the sample, further cushioned the labour market by ensuring wage continuity for 92.5% of workers, who received the equivalent of two-thirds of their pre-pandemic gross salary through cost-sharing between employers and social security. These arrangements align with [Eurofound \(2024\)](#), which highlights the role of wage-protection and stabilisation mechanisms across EU countries in reducing the social costs of the crisis.

However, evidence that 61% of firms in sectors such as Transport and Storage were unable to implement remote customer service channels indicates that opportunities for digital transformation were not evenly distributed, echoing findings on the uneven geography of remote work in Europe ([Luca et al., 2025](#)). In such contexts, limited capacity to adopt remote and digitally mediated work may have heightened perceived vulnerability, particularly in activities highly dependent on physical presence.

Within this broader institutional setting, the analysis with control variables reveals substantial heterogeneity in perceived job security. Women reported higher job security than men, a pattern that can be interpreted in light of Portugal's constitutional emphasis on equality and long-standing gender equality policies, even though it contrasts with evidence of higher female unemployment (CIMH/CGTP-IN, 2021). This apparent paradox echoes the literature showing that women particularly value the flexibility of telework while remaining more vulnerable in labour market participation (Grave et al., 2025; Rebelo et al., 2024), suggesting that telework and labour market measures are mediated by gendered experiences. Regional disparities also emerged: employees in the Lisbon Metropolitan Area reported more negative effects on job security than those in other regions, possibly reflecting the concentration of service and tourism-related jobs more exposed to restrictions, while workers in smaller firms felt more secure, in line with studies highlighting the resilience of SMEs (Achim et al., 2022; E. Santos & Castanho, 2022; Kryzhanovskij et al., 2021).

Hierarchical and work-regime differences add further nuance. Directors reported greater negative effects on their job security than non-managerial workers, which may stem from their higher exposure to strategic uncertainty and organisational responsibility, while frontline employees benefited more directly from state-backed protective measures (Barros, 2021). Finally, employees in distance or mixed regimes post-COVID-19 perceived lower job security than those working face-to-face, which can be linked to the view that remote tasks are more susceptible to automation and replacement by digital tools, echoing concerns about the vulnerability of certain white-collar roles (Rodriguez-Bustelo et al., 2020; Richiardi et al., 2025; Ho et al., 2025). Rather than confirming a strong direct effect of digitalisation on job security, these findings suggest that digital and organisational transformations interact with gender, region, firm size, hierarchy, and work regime to shape heterogeneous perceptions of security. H2 is therefore only partially supported: digitalisation does not systematically reduce perceived job security in the model, but specific digitally mediated work arrangements and structural conditions are associated with heightened or reduced feelings of vulnerability. However, the lack of a robust direct effect in the full model should not be interpreted as evidence that digitalisation is irrelevant for job security, but rather that its influence operates through specific organisational arrangements and institutional settings, which shape how workers perceive continuity and vulnerability.

From a conceptual standpoint, our formative job security construct mainly captures continuity-oriented outcomes, such as remaining employed, avoiding wage cuts, and preserving contract conditions, rather than subjective feelings of insecurity. The lack of a robust direct effect of digitalisation on this index may therefore partly reflect measurement choices, as the dominant job insecurity literature emphasises perceived risk and anticipation of deterioration rather than realised changes. At the same time, in Portugal, strong institutional protection mechanisms during COVID-19 (job retention schemes, wage protection measures, layoff arrangements) cushioned employment risks, suggesting that short term job security was driven more by public policies and structural factors than by digital work reorganisation alone. In line with the literature that highlights contextual and indirect pathways between digitalisation and job security, our results suggest that any insecurity effects tend to emerge through structural and organisational channels such as firm size, work regime, or regional context, rather than via a strong, uniform direct effect of digitalisation on employment continuity.

6. Conclusions

This study examined how pandemic-induced digitalisation, conceptualised as the reconfiguration of work at the job level through the transition to remote work, the enforced use of digital tools, and changes in tasks and digital skills, is associated with employees'

perceptions of job quality and job security in Portugal. The PLS-SEM results indicate that digitalisation has a positive and statistically significant effect on perceived job quality, particularly in terms of wages, social care, social environment, and mental health, two years after the onset of the pandemic. By contrast, no robust direct effect of digitalisation on perceived job security was found, suggesting that short-term employment stability was more strongly shaped by institutional protection and structural factors than by digital reorganisation of work alone.

The analysis with control variables shows that job security was unequally distributed across social and organisational groups. Women reported higher perceived job security than men, employees in smaller firms felt more secure than those in large companies, and workers in face-to-face regimes perceived greater stability than those in remote or mixed arrangements. In addition, living in the Lisbon Metropolitan Area was associated with lower perceived job security, despite its reputation as a region of high employment opportunities. These patterns highlight that digitalisation processes interacted with pre-existing inequalities and labour market structures, rather than producing homogeneous effects across the workforce.

6.1. Theoretical and Practical Implications

The findings contribute to debates on the future of work by showing that digitalisation centred on remote work and digital tools can enhance certain dimensions of job quality without necessarily eroding job security in the short term, when strong protective policies are in place. In the Portuguese context, measures such as job-retention schemes and credit lines for firms appear to have cushioned the effect of the crisis on employment, helping to explain why digitalisation did not translate into widespread perceptions of insecurity. At the same time, the more negative perceptions of security among employees in remote or mixed regimes support concerns that digitally mediated work may be seen as more exposed to automation and organisational restructuring, particularly in large firms and in metropolitan areas.

From a policy perspective, the results underline the importance of combining digital transformation strategies with measures that explicitly address distributional effects across gender, regions, firm sizes, and work regimes. Strengthening social protection, supporting smaller firms that offer more stable conditions, and regulating remote work to prevent excessive vulnerability could help sustain both job quality and security in a post-COVID-19 labour market. Policies that promote digital skill development and fair working conditions in remote and hybrid settings are especially relevant, as they may mitigate perceived risks while allowing workers to benefit from the flexibility and autonomy associated with digitalisation.

6.2. Limitations and Future Directions

This study has several limitations that should be acknowledged. First, the constructs were measured using binary indicators and difference variables comparing pre- and post-pandemic perceptions, which reduces variability and may attenuate reliability estimates, particularly for job quality and job security. Future studies should employ more fine-grained, multi-item scales that separately capture subjective job insecurity and different dimensions of job quality. Second, digitalisation was operationalised through three formative indicators capturing remote work, IT use, and changes in tasks, which offer an empirically grounded but necessarily narrow view of a broader and multidimensional process. Third, the data were collected via a telephone survey, which may be subject to social desirability bias, and the analysis relied on PLS-SEM, an approach suited to exploratory research but less stringent in terms of global model fit than covariance-based SEM.

Moreover, the study focused on employees in Portugal, which limits the generalisability of the findings to other institutional contexts and labour markets. Future research

could extend this work by using more fine-grained and multi-item scales for digitalisation, job quality, and job security by incorporating mediating or moderating variables such as digital skills, organisational culture, or sector, as well as by comparing different countries or sectors. Longitudinal designs would also be valuable to assess whether the observed patterns persist once emergency policies are withdrawn and digital work arrangements become more structurally embedded. Such developments would help to clarify the mechanisms through which digitalisation shapes employment conditions and to design more targeted interventions for a fair and inclusive digital transition.

Author Contributions: Conceptualization, F.A., J.M., J.P., J.S. and C.L.; methodology, F.A., A.P., C.L. and J.P.; software, C.L., F.A. and A.P.; validation, F.A., J.M., C.L., J.S. and A.P.; formal analysis, F.A., C.L. and A.P.; investigation, F.A., J.M., J.P., J.S. and C.L.; resources, F.A.; data curation, C.L. and F.A.; writing—original draft preparation; J.M., C.L. and J.S.; visualization, C.L.; supervision, F.A.; project administration, F.A.; funding acquisition, F.A. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by FUNDAÇÃO “LA CAIXA,” grant number FP21-1B014.

Institutional Review Board Statement: The study was approved by Instituto Superior Politécnico Gaya Ethical Commission (EA—0002501, 2 January 2022).

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The original contributions presented in this study are included in the article. Further inquiries can be directed to the corresponding author.

Conflicts of Interest: The authors declare no conflicts of interest.

Abbreviations

The following abbreviations are used in this manuscript:

AI	Artificial intelligence
AVE	Average variance extracted
BMJ	British Medical Journal
COVID-19	Coronavirus disease 2019
DOAJ	Directory of Open Access Journals
ECO	Portuguese Economy News
EU	European Union
GEE	Office for Strategy and Studies (Portugal)
HDI	Human Development Index
ILO	International Labour Organization
IT	Information technology
NUTS	Nomenclature of Territorial Units for Statistics
OECD	Organisation for Economic Co-operation and Development
PLS-SEM	Partial least squares-structural equation modelling
PCA	Principal component analysis (<i>conceptually referenced</i>)
SEM	Structural equation modelling
SM-COVID-19	Mental Health in Times of COVID-19 (report title)
SME(s)	Small and medium-sized enterprises
SRMR	Standardised root mean square residual
SSRN	Social Science Research Network
TLA	Three-letter acronym
UN	United Nations
WEF	World Economic Forum
WHO	World Health Organization

Appendix A

Table A1. Robustness checks retaining SE_DIF55, P28, P16a, and P22b.

Hypothesis	Model 1	Model 2
H1: Digitalisation → Job Quality	0.128	0.120
H2: Digitalisation → Job Security	0.191	0.177

Path coefficients are presented for each model. Model 1 (with all the indicators); Model 2 (without SE_DIF55, P28, P16a and P22b). Source: own elaboration.

In terms of the hypotheses of the structural model, Table A2 shows that both hypotheses were supported in Model 2, none were supported in Model 2 with all control variables, and only H1 was supported in Model 2 with the significant control variables.

Table A2. Comparison between models for hypothesis supporting.

Hypothesis	Model 2		Model 2—CV		Model 2—Only Sig CV	
	Std Coefficient	p-Value	Std Coefficient	p-Value	Std Coefficient	p-Value
H1: Digitalisation → Job Quality	0.127 (0.028)	0.000	0.026 (0.053)	0.658	0.117 (0.026)	0.000
H2: Digitalisation → Job Security	0.182 (0.029)	0.000	0.014 (0.037)	0.740	0.033 (0.034)	0.352

Standardised coefficient is represented by: sample mean (standard deviation). Bootstrapping: 10,000 samples; bias-corrected; two-tailed tests; significance level 0.05. Source: own elaboration.

References

- Acemoglu, D., & Restrepo, P. (2018). *Artificial intelligence, automation and work* (MIT Department of Economics Working Paper No. 18-01). Massachusetts Institute of Technology. [CrossRef]
- Achim, M. V., Safta, I. L., Văidean, V. L., Mureșan, G. M., & Borlea, N. S. (2022). The impact of COVID-19 on financial management: Evidence from Romania. *Economic Research—Ekonomika Istraživanja*, 35(1), 1807–1832. [CrossRef]
- Ali, F., Rasoolimanesh, S. M., Sarstedt, M., Ringle, C. M., & Ryu, K. (2018). An assessment of the use of partial least squares structural equation modeling (PLS-SEM) in hospitality research. *International Journal of Contemporary Hospitality Management*, 30(1), 514–538. [CrossRef]
- Almeida, A. R., Rebelo, G., & Pedra, J. P. (2025). New risks in hybrid work and teleworking contexts—Insights from a study in Portugal. *Sustainability*, 14(8), 478. [CrossRef]
- Almeida, F., Heitor, M. J., Santos, O., Costa, A., Virgolino, A., Rasga, C., Martiniano, H., & Vicente, A. (2020). *Relatório final: SM-COVID19—Saúde mental em tempos de pandemia*. Instituto Nacional de Saúde Doutor Ricardo Jorge.
- Almeida, F., & Monteiro, J. A. (2020). The response of national and local Portuguese government authorities to COVID-19. *HOLISTICA—Journal of Business and Public Administration*, 11(3), 1–10. [CrossRef]
- Almeida, F., Morais, J., & Pereira, A. (2022). Portuguese volunteer firefighters in the context of the challenges posed by the COVID-19 pandemic. *Social Sciences*, 11(7), 285. [CrossRef]
- Almeida, F., & Santos, J. D. (2020). The effects of COVID-19 on job security and unemployment in Portugal. *International Journal of Sociology and Social Policy*, 40(9/10), 995–1003. [CrossRef]
- Alves, J., Soares, P., Rocha, J. V., Santana, R., & Nunes, C. (2021). Evolution of inequalities in the coronavirus pandemics in Portugal: An ecological study. *European Journal of Public Health*, 31(5), 1069–1075. [CrossRef] [PubMed]
- Amankwah-Amoah, J., Khan, Z., Wood, G., & Knight, G. (2021). COVID-19 and digitalization: The great acceleration. *Journal of Business Research*, 136, 602–611. [CrossRef] [PubMed]
- Barros, G. O. (2021). *Digitalization, skills and cybersecurity in Portugal: Critical factors in a digital economy driven by COVID-19* (TE 89). Gabinete de Estratégia e Estudos. Available online: <https://www.gee.gov.pt/pt/estudos-e-seminarios/estudos-de-temas-economicos-category/31552-te-89-digitalisation-skills-and-cybersecurity-in-portugal-critical-factors-in-a-digital-economy-driven-by-covid-19> (accessed on 6 October 2021).
- Bouziri, H., Smith, D. R. M., Descatha, A., Dab, W., & Jean, K. (2020). Working from home in the time of COVID-19: How to best preserve occupational health? *Occupational and Environmental Medicine*, 77(7), 509–510. [CrossRef]
- Chin, W. W. (2010). Handbook of partial least squares. In V. E. Vinzi, W. W. Chin, J. Henseler, & H. Wang (Eds.), *Handbook of partial least squares: Concepts, methods and applications* (pp. 655–690). Springer.
- CIMH/CGTP-IN. (2021). *Estudo 5: As implicações do teletrabalho na vida das mulheres e das famílias*. Available online: https://www.cgtp.pt/images/images/2021/02/ESTUDO-5_implicacoes-teletrabalho-vida-das-mulheres-fam%C3%ADlias.pdf (accessed on 18 February 2021).

- Dengler, K., & Matthes, B. (2018). The impacts of digital transformation on the labour market: Substitution potentials of occupations in Germany. *Technological Forecasting and Social Change*, 137, 304–316. [CrossRef]
- ECO News. (2025, June 3). *Contact centre wages rise by more than 4%: Remote work decreases again*. Available online: <https://econews.pt/2025/06/03/contact-centre-wages-rise-by-more-than-4-remote-work-decreases-again/> (accessed on 3 June 2025).
- Eurofound. (2024). *Working life in Portugal*. Available online: <https://www.eurofound.europa.eu/en/publications/all/working-life-portugal> (accessed on 1 June 2024).
- European Commission. (n.d.). *Portugal's recovery and resilience plan*. Available online: https://commission.europa.eu/business-economy-euro/economic-recovery/recovery-and-resilience-facility/country-pages/portugals-recovery-and-resilience-plan_en (accessed on 11 February 2026).
- Faustino, D., Sousa, M., & Gonçalves, M. M. (2023). Perceção do impacto do teletrabalho na carreira: Validação da escala do impacto do teletrabalho na Carreira. *Revista Iberoamericana de Diagnóstico y Evaluación-e Avaliação Psicológica*, 67(1), 5–17. [CrossRef]
- Gabryelczyk, R. (2020). Has COVID-19 accelerated digital transformation? Initial lessons learned for public administrations. *Information Systems Management*, 37(4), 303–309. [CrossRef]
- Gomes, S., Lopes, J. M., & Oliveira, J. (2022). Online food shopping: Determinants and profile of Portuguese buyers in the pandemic context. *Innovar*, 33(87), 73–81. [CrossRef]
- Grave, R., Rebelo, G., & Santos, M. J. (2025). It's all about flexibility! A case study on telework in a Portuguese company after the COVID-19 pandemic. *Humanities and Social Sciences Communications*, 12(1), 5013. [CrossRef]
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2022). *A primer on partial least squares structural equation modeling (PLS-SEM)*. Sage.
- Henseler, J., Hubona, G., & Ray, P. A. (2016a). Using PLS path modeling in new technology research: Updated guidelines. *Industrial Management & Data Systems*, 116(1), 2–20. [CrossRef]
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2016b). Testing measurement invariance using partial least squares. *International Marketing Review*, 33(3), 405–431. [CrossRef]
- Henseler, J., & Schuberth, F. (2020). Using confirmatory composite analysis to assess emergent variables. *Journal of Business Research*, 120, 147–156. [CrossRef]
- Hensher, M. (2020). COVID-19, unemployment, and health: Time for deeper solutions? *BMJ*, 371, m3687. [CrossRef]
- Heredia, J., Castillo-Vergara, M., Geldes, C., Gamarra, F. M. C., Flores, A., & Heredia, W. (2022). How do digital capabilities affect firm performance? *Journal of Innovation & Knowledge*, 7(2), 100171. [CrossRef]
- Ho, T. L., Le, H. N., & Ho, T. H. (2025). Digital inclusion or exclusion? Exploring the moderating role of governance in digitalization's impact on income inequality in developing countries. *Research in Globalization*, 10, 100283. [CrossRef]
- Hodder, A. (2020). New technology, work and employment in the era of COVID-19. *New Technology, Work and Employment*, 35(3), 262–275. [CrossRef]
- Hu, L.-T., & Bentler, P. M. (1998). Fit indices in covariance structure modeling. *Psychological Methods*, 3(4), 424–453. [CrossRef]
- Hulland, J. (1999). Use of partial least squares (PLS) in strategic management research: A review of four recent studies. *Strategic Management Journal*, 20(2), 195–204. [CrossRef]
- Koch, A. B. M. (2022). *Estudo de caso: Resposta(s) da emergente problemática da saúde mental em contexto laboral durante a pandemia* [Master's thesis, Universidade Católica Portuguesa].
- Kryzhanovskij, O. A., Baburina, N. A., & Ljovkina, A. O. (2021). How to make digitalization better serve quality of life. *Sustainability*, 13(2), 611. [CrossRef]
- Kudyba, S. (2020). COVID-19 and the acceleration of digital transformation. *Information Systems Management*, 37(4), 284–287. [CrossRef]
- Kutnjak, A. (2021). COVID-19 accelerates digital transformation. *IEEE Access*, 9, 79373–79388. [CrossRef]
- Labour Relations Agency. (2020). *A practical guide to working from home: COVID-19 and beyond*. Available online: <https://www.lra.org.uk/> (accessed on 4 July 2020).
- Lewis, L. (2020). *Changing demographics and ageing workforces*. Future of Work Hub. Available online: <https://www.futureofworkhub.info/> (accessed on 26 June 2024).
- Lopes, A. S., & Carreira, P. (2022). COVID-19 impact on job losses in Portugal. *International Journal of Manpower*, 43(5), 1265–1282. [CrossRef]
- Lopes, A. S., Sargento, A., & Carreira, P. (2021). Vulnerability to unemployment in hospitality. *International Journal of Contemporary Hospitality Management*, 33(5), 1850–1869. [CrossRef]
- Lopes, J., & Oliveira, J. (2022). The new times of social media marketing. *Businesses*, 2(2), 156–167. [CrossRef]
- Loureiro, R., Ferreira, J. J. M., & Simões, J. (2021). Dynamic capabilities: Measurement approaches. *Journal of Engineering and Technology Management*, 62, 101657. [CrossRef]
- Luca, D., Özgüzel, C., & Wei, Z. (2025). The new geography of remote jobs in Europe. *Regional Studies*, 59(1), 2352526. [CrossRef]
- Makridakis, S. (2017). The forthcoming AI revolution. *Futures*, 90, 46–60. [CrossRef]
- Marguerit, D. (2025). Augmenting or automating labor? The effect of AI development on new work, employment, and wages. *arXiv*. [CrossRef]

- Mehta, P. (2021). Work from home—Work engagement amid COVID-19 lockdown and employee happiness. *Journal of Public Affairs*, 21(4), e2709. [CrossRef]
- Modgil, S., Dwivedi, Y. K., Rana, N. P., Gupta, S., & Kamble, S. (2022). COVID-19 and digital entrepreneurship. *Technological Forecasting and Social Change*, 175, 121415. [CrossRef] [PubMed]
- Moretti, A., Menna, F., Aulicino, M., Paoletta, M., Liguori, S., & Iolascon, G. (2020). Characterization of home working population during COVID-19. *International Journal of Environmental Research and Public Health*, 17(17), 6284. [CrossRef] [PubMed]
- Müller, T., Schuberth, F., & Henseler, J. (2018). PLS path modeling. *Journal of Hospitality and Tourism Technology*, 9(3), 249–266. [CrossRef]
- NI Business Info. (n.d.). *Employees working from home*. Available online: <https://www.nibusinessinfo.co.uk/> (accessed on 26 June 2025).
- OECD. (2020). *Enterprises by business size*. Available online: <https://data.oecd.org/> (accessed on 20 December 2020).
- Okuyan, C., & Begen, M. A. (2022). Working from home during the COVID-19 pandemic. *Perspectives in Psychiatric Care*, 58(1), 173–179. [CrossRef]
- Perelman, J., Serranheira, F., Pita Barros, P., & Laires, P. (2024). Teleworking: Does it make workers healthier and productive? A cross-sectional study on a Southern European population. *BMC Public Health*, 24, 19481. [CrossRef]
- PORDATA. (n.d.). *Censos de 2021*. Available online: <https://www.pordata.pt/> (accessed on 13 May 2022).
- PORDATA. (2013). *NUTS—Nomenclature of territorial units for statistics*. Available online: <https://www.pordata.pt/> (accessed on 13 May 2022).
- Rebelo, D., Garcia, A. D., Santos, T. R., Carvalho, A., & Malafaia, C. (2024). Prioritising communities: Barriers to climate activism and political imagination among minoritised youth groups. *Journal of Youth Studies*, 29(2), 222–242. [CrossRef]
- Richiardi, M., Gaffeo, E., & Zoli, M. (2025). The impact of a decade of digital transformation on employment, wages, and inequality in the EU: A “conveyor belt” hypothesis. *Socio-Economic Review*, 23(3), 1225–1256. [CrossRef]
- Rigdon, E. E. (2016). Choosing PLS path modeling. *European Management Journal*, 34(6), 598–605. [CrossRef]
- Ringle, C. M., & Sarstedt, M. (2016). Importance–performance map analysis. *Industrial Management & Data Systems*, 116(9), 1865–1886.
- Ringle, C. M., Wende, S., & Becker, J.-M. (2022). *SmartPLS 4*. Available online: <https://www.smartpls.com/> (accessed on 30 June 2022).
- Rodriguez-Bustelo, C., Batista-Foguet, J. M., Serlavós, R., Pons, P. S., & Rodriguez, J. R. (2020). Debating the future of work: The perception and reaction of the Spanish workforce to digitization and automation technologies. *Frontiers in Psychology*, 11, 1965. [CrossRef] [PubMed]
- Ryder, G. (2020). *ILO welcomes G20 commitment*. Available online: <https://www.ilo.org/> (accessed on 26 June 2022).
- Ryder, G. (2021). *Trabalho em tempos de COVID*. International Labour Organization.
- Santos, E., & Castanho, R. A. (2022). Size and TNC performance. *Sustainability*, 14(2), 717.
- Santos, P. P., & Ferreira, T. M. (2023). Social vulnerability in Lisbon. In *Multi-risk interactions towards resilient and sustainable cities* (pp. 27–49). Springer.
- Sarstedt, M., Hair, J. F., Cheah, J.-H., Becker, J.-M., & Ringle, C. M. (2019). Higher-order constructs in PLS-SEM. *Australasian Marketing Journal*, 27(3), 197–211. [CrossRef]
- Sarstedt, M., Henseler, J., & Ringle, C. M. (2011). Multigroup analysis. In *Advances in international marketing* (pp. 195–218). Emerald.
- Scarlat, C., Stănculescu, G. D., & Panduru, D. A. (2022). COVID-19 pandemic as accelerator: Opportunity for digital acceleration. *Journal of Internet and e-Business Studies*, 2022, 296375. [CrossRef]
- Sequeira, A., Manteu, C., & Monteiro, N. (2020). *The short-term impact of the COVID-19 pandemic on Portuguese companies*. Banco de Portugal.
- Smith, A., & Anderson, J. (2014). *AI, robotics, and the future of jobs*. Pew Research Center.
- Vieira, D. A., & Meirinhos, V. (2021). COVID-19 lockdown in Portugal. *Trends in Psychology*, 29(2), 354–374. [CrossRef]
- World Economic Forum. (2020). *The future of jobs report 2020*. World Economic Forum.
- Yang, E., Kim, Y., & Hong, S. (2023). Does working from home work? Experience of working from home and the value of hybrid workplace post-COVID-19. *Journal of Corporate Real Estate*, 25(1), 50–76. [CrossRef]
- Zhen, Z., Yousaf, Z., Radulescu, M., & Yasir, M. (2021). Digital organizational culture and innovation. *Sustainability*, 13(2), 720. [CrossRef]

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