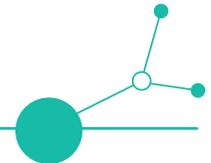




D1.3.1

Digital-era-fit models for triple helix, digital & telework culture and technol. adaptation



Version 1

11 2025





PROJECT

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1.1	20.11.2025	First version of the report	UNIBO
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EXECUTIVE SUMMARY

Digital transformation (DT) is reshaping work across all sectors, creating new opportunities for innovation and efficiency while simultaneously introducing new pressures, skill demands, and psychosocial risks. This deliverable presents the development and initial validation of the **digital-era-fit model** and its accompanying **assessment tool**, designed to help organisations evaluate how well they manage the human and organisational aspects of digitalisation. Grounded in the Job Demands-Resources (JD-R) framework and the multilevel T+IGLOO model, the digital-era-fit model provides a structured way to analyse how digital demands and resources operate at six key levels: Technological, Individual, Group, Leadership, Organisational, and Overarching.

Methodology: The assessment tool was developed through several iterations of item development, expert review, and psychometric testing. Because existing instruments did not fully capture the complexity of DT demands and resources, new items were created for each level. These were piloted in an approbation study involving **294 working participants** from Central European countries, recruited through the Prolific platform.

Results: Statistical analyses (including item-level diagnostics, internal reliability checks, inter-scale correlations and factor analysis) demonstrated that the tool has good psychometric properties. In line with theoretical expectations, digital demands and digital resources formed two relatively independent clusters. Demands such as technological complexity, cognitive overload, and unsupportive leadership were strongly associated with burnout and technostress. Resources, on the other hand, such as supportive leadership, integrated digital systems, and clear organisational policies, showed positive associations with job satisfaction, performance, and perceived DT level. Importantly, correlations between demands and resources were weak, confirming that organisations may simultaneously experience high demands and high resources, or any other combination.

Implications: The digital-era-fit model and tool offer a diagnostic method for identifying where DT efforts are progressing smoothly and where targeted interventions may be needed. For example, high technological demands combined with low technological resources may signal system fragmentation or insufficient IT support, while high individual demands paired with low individual resources may indicate a need for skill development or clearer expectations. Similarly, issues at the group, leadership, or organisational level can be diagnosed and addressed using evidence-based recommendations. Overall, the digital-era-fit model provides organisations with a clear, actionable framework for supporting employee well-being, strengthening digital readiness, and creating sustainable DT strategies.



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ACRONYMS & ABBREVIATIONS

TERM	DESCRIPTION
DT	Digital Transformation
JD-R	Job Demands-Resources model
SMEs	Small and Medium Enterprises
T+IGLOO	Technological, Individual, Group, Leadership, Organisational, and Overarching levels of interventions
“triple helix”	Academic institutions, public authorities, and SMEs



D1.3.1.

DIGITAL-ERA-FIT MODELS FOR TRIPLE HELIX, DIGITAL & TELEWORK CULTURE AND TECHNOL. ADAPTATION

1. INTRODUCTION

In the previous deliverables, D.1.1.1 “*Analysis Report of Digitalisation Needs and Challenges in CE and Current State of Digitalisation*” and D.1.2.1 “*Digitalisation Methodology for Manufacturing SMEs, Public Authorities and Academia*,” we introduced and briefly explained two theoretical frameworks: the Job Demands-Resources (JD-R) model (Bakker & Demerouti, 2007, 2017) and the multilevel framework of organisational interventions (Nielsen et al., 2018). The **digital-era-fit model** will be further developed based on these two foundational frameworks.

1.1. Overview of the JD-R model

The JD-R model (Bakker & Demerouti, 2007, 2017) has become one of the most influential frameworks for understanding employee well-being, motivation, and performance. It posits that every occupation comprises a specific constellation of **job demands** and **job resources**, which jointly influence outcomes through two interrelated psychological processes: a health impairment process and a motivational process.

- **Job demands** refer to those physical, psychological, social, or organisational aspects of work that require sustained effort and are therefore associated with certain physiological and psychological costs (e.g., workload, time pressure, emotional strain). When excessive, such demands can deplete energy and result in strain or burnout (Schaufeli, 2017).
- **Job resources**, by contrast, are those aspects of work that help employees achieve work goals, reduce the negative impact of job demands, or stimulate learning and personal growth (e.g., autonomy, social support, feedback) (Bakker et al., 2023).

The JD-R model proposes that high job demands activate an energy-depleting health impairment process, whereas abundant job resources trigger a motivational process that fosters engagement, organisational commitment, and improved performance ((Bakker & Demerouti, 2017; Berthelsen et al., 2018). The model’s flexibility allows it to accommodate diverse contexts, including crises (Demerouti & Bakker, 2023) and digital transformation (Scholze & Hecker, 2024).



1.2. Digital transformation as a source of Job Demands and Resources

Digital transformation (DT), defined as the integration of digital technologies into all areas of organisational activity, has profoundly reshaped work characteristics and employee experiences (Hortovanyi et al., 2023). This process introduces both new job demands (for example, technostress, digital overload, and the expectation of constant availability) and new job resources (such as digital autonomy, flexibility, and enhanced collaboration) that can be effectively conceptualised within the JD-R framework (Li et al., 2025; Scholze & Hecker, 2024).

Scholze and Hecker (2024) extended the JD-R model by explicitly including digital job demands and digital job resources. They defined **digital job demands** as technology-related aspects of work requiring sustained cognitive, emotional, or social effort (e.g., information overload, continuous connectivity, and dependence on digital tools). **Digital job resources**, conversely, comprise technological and social factors that enable employees to achieve goals and maintain well-being, such as digital autonomy, efficient systems, and supportive communication tools.

Similarly, Li et al. (2025) demonstrated that digital resources, including digital culture, leadership, knowledge management, and human resource management, can **mitigate technostress** and **protect mental well-being**. Their findings reinforce the JD-R assumption that adequate resources buffer the effects of job demands, thereby maintaining health and motivation in digitalised work environments.

DT thus simultaneously acts as both a **stressor** and a **motivator**. On one hand, rapid technological change can increase workload, uncertainty, and complexity (Schaufeli, 2017); on the other, it creates new opportunities for autonomy, skill development, and innovation (Bakker et al., 2023). The JD-R model provides a good framework for analysing this duality and understanding how digitalisation reshapes organisational work dynamics.

1.3. The IGLOO multilevel framework of organisational interventions

The **IGLOO framework** (Individual, Group, Leadership, Organisational, and Overarching levels) is a multilevel model of organisational interventions originally conceptualised by Nielsen et al. (2018) to promote employee well-being and organisational performance. It emphasises that effective interventions must address multiple, interacting levels of the work system rather than focusing solely on individuals.

At its core, the IGLOO model integrates systemic thinking from occupational health psychology with organisational change theory (Day & Nielsen, 2017). The five levels can be summarised as follows:

- **Individual level:** focuses on personal resources, attitudes, competencies, and coping strategies.
- **Group level:** concerns team dynamics, communication, collaboration, and social support.
- **Leadership level:** involves managerial behaviours, participative leadership, and support for change.
- **Organisational level:** refers to policies, structures, cultures, and practices that shape working conditions.



- **Overarching (contextual) level:** encompasses societal, economic, and institutional factors such as labour market trends, national policies, and technological developments.

The model is widely applied to diagnose psychosocial risks and to design sustainable interventions that link organisational change to employee well-being and performance outcomes (Nielsen et al., 2017).

1.4. Extending the framework: the technological dimension in the T+IGLOO Model

In the context of DT, the IGLOO framework requires further development to explicitly recognise the technological environment as a distinct yet interdependent system influencing all levels of work. Based on insights from Deliverable D.1.1.1 (“*Analysis Report of Digitalisation Needs and Challenges in CE and Current State of Digitalisation*”), we propose the **T+IGLOO model**, in which the “**T**” (**Technological level**) precedes the traditional IGLOO layers.

This addition reflects the pervasive impact of digitalisation on work design, culture, and capability development across all organisational layers (Brink & Packmohr, 2023; Mukhopadhyay et al., 2025). The technological level captures digital infrastructure, data systems, cybersecurity, automation, and digital tools that both enable and constrain organisational processes (Bjerke-Busch & Aspelund, 2021).

The T+IGLOO model positions technology as a foundational enabler that shapes the capacity of individuals, teams, leaders, and organisations to adapt. This approach aligns with the socio-technical systems tradition, recognising that DT is not merely a technological shift but an interplay of human, structural, and digital factors (Hortovanyi et al., 2023).

Furthermore, the technological layer acts as both a source of job demands and job resources, influencing well-being and performance as conceptualised in the JD-R model. For example, complex digital systems may increase cognitive demands (technostress), while efficient digital platforms may enhance collaboration and efficiency.

1.5. Examples of digital job demands and resources by T+IGLOO Levels

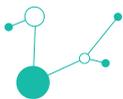
Drawing on the integration of the **JD-R theory** (Bakker et al., 2023; Li et al., 2025) with the **T+IGLOO model**, digital job demands and resources can be mapped across the six levels as follows:

Table 1. Examples of digital job demands and resources by T+IGLOO Levels

LEVEL	DIGITAL JOB DEMANDS	DIGITAL JOB RESOURCES
Technological	<ul style="list-style-type: none"> • System complexity and integration issues • Cybersecurity risks and compliance burdens • Rapid obsolescence of software and hardware 	<ul style="list-style-type: none"> • Reliable IT infrastructure and interoperability • Data analytics, automation, and AI tools that streamline processes • Technical support and maintenance systems
Individual	<ul style="list-style-type: none"> • Technostress, information overload 	<ul style="list-style-type: none"> • Digital skills and self-efficacy



	<ul style="list-style-type: none"> • Skill gaps and pressure for constant upskilling • Blurred boundaries due to connectivity 	<ul style="list-style-type: none"> • Access to e-learning platforms and microlearning • Autonomy in using digital tools
Group	<ul style="list-style-type: none"> • Coordination difficulties in virtual teams • Communication overload and misinterpretation 	<ul style="list-style-type: none"> • Collaborative digital platforms (e.g., MS Teams, Miro) • Virtual trust-building practices • Clear communication protocols
Leadership	<ul style="list-style-type: none"> • Managing hybrid teams and digital resistance • Lack of strategic digital vision 	<ul style="list-style-type: none"> • Digital leadership competencies (supportive, transparent, adaptive) • Empowering communication and innovation culture
Organisational	<ul style="list-style-type: none"> • Legacy systems and paper-based processes • Resistance to change and unclear digital strategy 	<ul style="list-style-type: none"> • Organisational digital culture and strategy • Cross-functional integration and agile practices • Investment in continuous transformation
Overarching	<ul style="list-style-type: none"> • Regulatory constraints • Unequal access to digital infrastructure across regions 	<ul style="list-style-type: none"> • Public funding and policy incentives for digitalisation • Sectoral standards and digital ecosystems • National strategies promoting digital maturity



2. DIGITAL-ERA-FIT MODEL

2.1. Conceptual model

Building on the two frameworks described above, the Digital-era-fit model was developed. In line with these theoretical foundations, we propose that DT introduces both new job demands and job resources within organisations. An increasing number of digital job demands can give rise to **digital stress** and, over time, contribute to **burnout**. Conversely, digital job resources enhance **motivation, engagement, and the willingness to adopt new technologies**, thereby improving overall **organisational digital readiness**. When digital job demands and resources are effectively balanced, employees are more likely to experience **digital well-being**, which in turn supports higher levels of **organisational digital maturity**.

An overview of the model is presented in Figure 1.

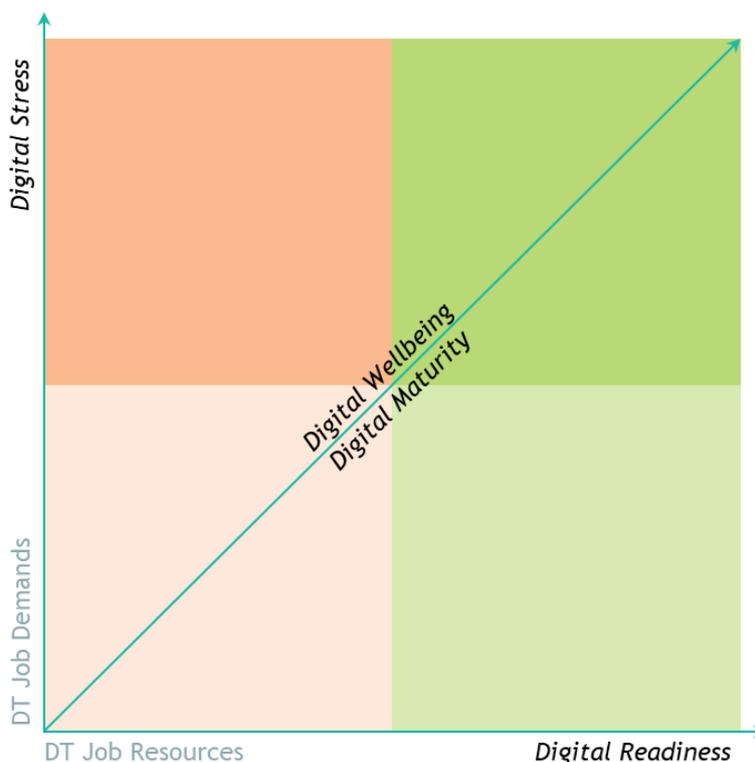


Figure 1. An overview of the digital-era-fit conceptual model

To illustrate how digital job demands and digital job resources can influence employees' stress and engagement in DT, the following examples show how the model works in real organisational contexts.

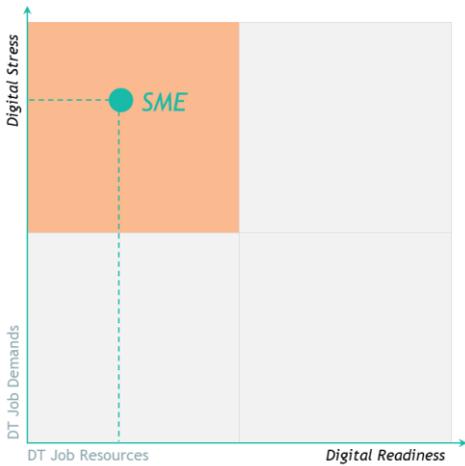


Figure 2. An example of the fit model (SME)

A **manufacturing SME** introduces several new digital tools at once. Employees face high technological demands because systems are complex, unstable, and require constant switching. With little training or IT support available, workers experience digital stress, frustration, and early signs of burnout, and their willingness to use new tools decreases. Under the digital-era-fit model, this organisation falls into the high-demands, low-resources quadrant (Figure 2), explaining why digitalisation is creating strain rather than engagement. Strengthening resources, such as training time and coherent digital systems, would help improve employees’ digital well-being and increase their readiness to adopt new technologies.

A **public administration** office launches a new digital citizen-service portal. Employees experience increased digital demands, such as learning new reporting procedures, managing system transitions, and handling additional administrative work. However, unlike the SME example, this organisation provides strong digital job resources: clear step-by-step instructions, structured training sessions, supportive supervisors, stable communication, and established workflows for digital collaboration. As a result, employees feel more confident, experience lower stress, and show higher engagement and motivation to use the new system. In the digital-era-fit model, this office sits in the moderate-demands, high-resources quadrant (Figure 3), which supports both digital well-being and successful digital transformation.

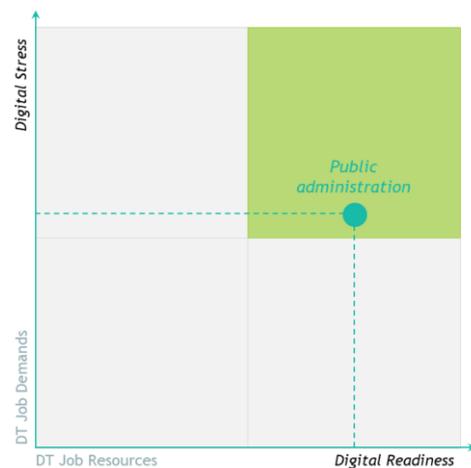


Figure 3. An example of the fit model (Public administration)

As outlined in the introduction, DT generates both demands and resources across the various T+IGLOO levels. This multilevel perspective makes it possible to assess **digital fits** at each level and to identify the strengths and shortcomings of different organisational domains, such as **innovation management** (leadership and organisational levels), **digital and telework culture** (group, leadership, and organisational levels), **upskilling and capability-building efforts** (individual and organisational levels), and **digital infrastructure and systems** (technological level).

Based on this conceptual model, we developed the first version of the digital-era-fit assessment tool.

2.2. Assessment tool

The assessment tool is designed to evaluate six dimensions, each corresponding to one T+IGLOO level, and to measure both DT demands and DT resources. The initial version of the tool included



ten items per dimension; however, following the pilot study, the final version is expected to contain five to seven items per dimension (see Figure 2).

	DT Demands	DT resources
Technological	5-7 questions	5-7 questions
Individual	5-7 questions	5-7 questions
Group	5-7 questions	5-7 questions
Leadership	5-7 questions	5-7 questions
Organisational	5-7 questions	5-7 questions
Overarching factors	5-7 questions	5-7 questions
	30-42 questions	30-42 questions

Figure 4. Overview of the digital-era-fit assessment tool

The final version of the assessment tool will be developed in two variants:

- 1) **For managers**, questions will be about what kind of demands/resources the work in your organisation requires from/provides to the employees.
- 2) **For individuals**, questions will be about what kind of demands/resources the work in your organisation requires from you and provides to you.

At this initial stage, questions for the individual version were developed, and the manager version will be based on the individual one, with some questions reframed to match the managerial context.

2.3. Methodology

2.3.1. Items development

Once the conceptual model was finalised, survey items were developed in alignment with its structure. We began with a review of existing assessment tools based on the JD-R model. As no validated instruments fully met the requirements of the digital-era-fit framework, new items capturing both digital demands and digital resources at each T+IGLOO level were created.

The item development process involved three iterations. First, an initial set of DT demands and resources for each level was defined. Based on this mapping, a draft pool of survey items was generated. Second, we applied embedding-based psychometric analysis (Guenole, 2025) to evaluate the alignment of each item with its intended factor. Finally, a third round of refinement was conducted, resulting in the final set of items.

The complete item set is provided in **Appendix 1**. All items are rated on a five-point Likert scale (Not true at all, Rather false, Somewhat true, True, Completely true). At the approbation stage, the resulting assessment tool was administered together with additional validated scales to evaluate the validity of both the digital-era-fit model and the assessment tool itself.



2.3.2. Approbation study

The resulting tool was digitalised and implemented in the **Qualtrics platform**. The final Qualtrics survey included **100 items** from the digital-era-fit assessment tool: **10 items each for both demands and resources across the five levels** (Technological, Individual, Group, Leadership, Organisational). At this stage, items relating to the **Overarching factor** were intentionally excluded to reduce survey length, as this level is more relevant for the managerial version of the tool and will be examined in subsequent pilot studies.

In addition to the Digital-era-fit items, the survey included the following validated scales and questionnaires (Table 2).

Table 2. Additional scales for model validation

	Scale	Number of items	Source
Strain	Burnout	4	COPSOQ III
	Technostress	4	(Ayyagari et al., 2011)
Well-being	Job Satisfaction	4	BIAJS
Organisational implications	Task performance	5	IWPQ
	Contextual performance	8	IWPQ
	Turnover intention	3	(Cohen, 1999)
	Level of digital transformation	6	(Brink & Packmohr, 2023)

These additional measures were incorporated to examine the relationships between DT demands, DT resources, health and well-being indicators, and organisational outcomes, thereby providing a broader basis for evaluating the construct validity of the model and the assessment tool.

2.3.3. Sample

Data for the approbation study were collected using the **Prolific** online research platform, which enabled access to a diverse and reliably screened participant pool across different countries. In our study, only full-time employees from Central European countries were invited to participate. After quality checks and the removal of incomplete responses, the final sample comprised **294 participants**.

The sample was gender-diverse, with 63,6% identifying as male, 35,4% as female, and a small minority selecting other (0,7%) or prefer not to say (0,3%).

Age was broadly distributed, though concentrated in the working-age population typical of digital-intensive occupations. Over half of the participants (52,4%) were aged 25-34, followed by 35-44 (27,2%), 18-24 (10,5%), 45-54 (6,1%), and 55-64 (3,4%). Only one participant (0,3%) was aged 65 or older (Figure 3).

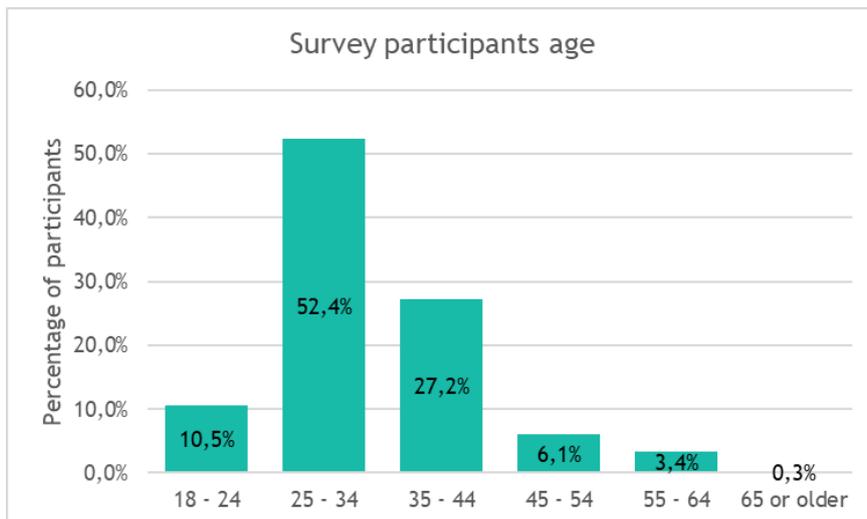


Figure 5. Survey participants' distribution by age

Although the sample reflects a typical working-age population in digital-intensive roles, representation of employees aged 50 and above was relatively low. Because this group is one of the key target populations of the project (particularly in relation to digital upskilling, technostress, and inclusion) it will be prioritised in the next stage of field validation. The forthcoming pilot studies in partner countries will therefore intentionally recruit participants aged 50+ to ensure that the assessment tool is fully validated for this important demographic group.

Participants were recruited from ten European countries. The largest proportions came from Poland (38,4%), Italy (20,1%), Germany (19,4%), and Hungary (9,9%). Smaller numbers were drawn from the Czech Republic (4,1%), Austria (3,1%), Slovenia (3,1%), Croatia (1,0%), and Slovakia (0,7%). One participant (0,3%) revoked consent for their country information (Figure 4).

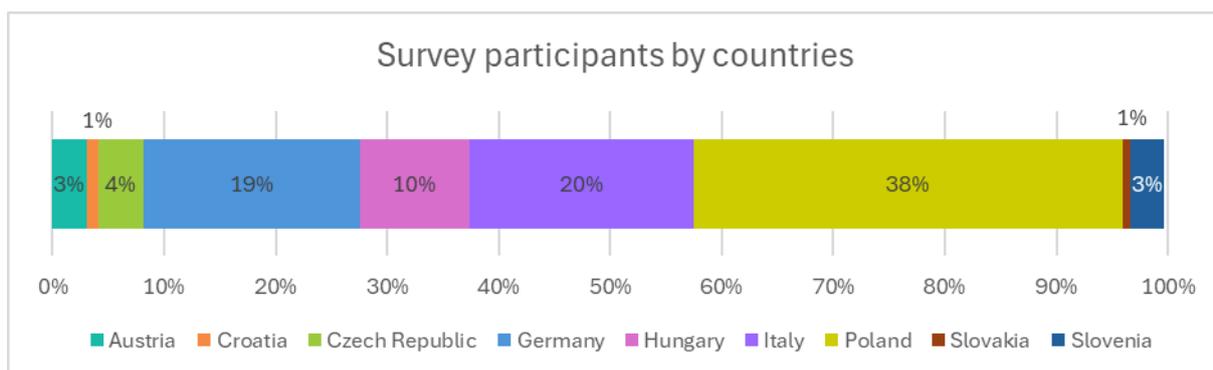


Figure 6. Survey participants' distribution by countries

Participants were employed across a broad range of organisational types. The largest groups were drawn from Small and Medium Enterprises (SMEs) (44,2%) and large enterprises (38,8%). Smaller proportions worked in public institutions such as government agencies or public hospitals (8,2%), academic institutions (6,1%), and non-profit organisations (2,0%). A small number of respondents (0,7%) reported working in other organisational settings (Figure 5). This distribution indicates that the sample reflects a broad organisational landscape, allowing the assessment tool to be tested across varied digitalisation contexts.

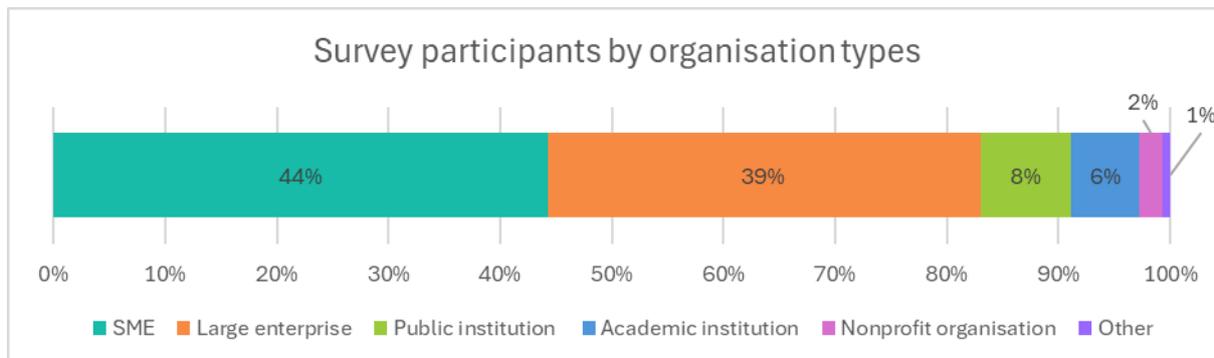


Figure 7. Survey participant' distribution by organisation types

While the sample includes a diverse mix of organisational types, public institutions and academic organisations are underrepresented compared with SMEs. As these sectors are central to the project's focus the next phase of tool validation will specifically target public bodies and universities. The planned field pilots across partner countries will ensure stronger representation from these organisational contexts to enhance the tool's applicability and relevance.

Most respondents identified as professional or mid-level employees (59,5%), followed by managers or supervisors (24,8%). Interns or entry-level employees represented 11,6% of the sample, while directors or executives accounted for 2,0%. Another 2,0% selected "other". This job-level distribution supports the evaluation of the tool across both operational and managerial roles.

2.3.4. Data analysis

A series of statistical analyses was conducted to evaluate the psychometric quality of the digital-era-fit assessment tool and to examine the structure of the proposed T+IGLO dimensions. All analyses were performed using established procedures for scale development and validation.

We first carried out a **descriptive analysis** of all items. This included examining means, standard deviations, and response distribution. The descriptive statistics enabled an initial assessment of item variability. Internal consistency was evaluated for each T+IGLO demand and resource dimension using **Cronbach's alpha (α)**. Reliability coefficients were interpreted using conventional psychometric thresholds ($\alpha \geq 0,70$ as reliable; $\alpha \geq 0,80$ as excellent). "Alpha if deleted" statistics were also reviewed to identify items that negatively affected the internal consistency of their respective scales.

Each item was further assessed using the following item-related statistics:

- **Difficulty (p):** reflecting the mean endorsement level on the Likert scale.
- **Item-total correlation (item-total r):** measuring the degree to which each item correlates with its respective scale score.
- **Discrimination index (D):** calculated by comparing the top and bottom item-score quartiles, indicating the extent to which items distinguish between high and low scorers.

Items with low discrimination, weak item-total correlations ($< 0,30$), or problematic distribution patterns were considered for revision.

We also examined **inter-scale correlations** to evaluate conceptual relationships between the DT demand and resource dimensions across T+IGLO levels, as well as relationships between the



digital-era-fit model factors and additional variables (burnout, technostress, job satisfaction, performance, turnover intentions and level of DT) (Appendix 2).

Finally, the survey factor structure was examined using EFA and CFA.



3. RESULTS

A comprehensive psychometric evaluation was conducted on the newly developed assessment tool. Item-level analyses, reliability coefficients, and inter-scale correlations all indicate that the instrument demonstrates sufficient measurement properties.

3.1. Item-level analyses

Across all 10 digital-era-fit assessment tool scales, items showed:

- Adequate variability (SDs typically around 1,0-1,2),
- Acceptable skewness and kurtosis, remaining well within recommended psychometric thresholds (skewness < |2|, kurtosis < |2|),
- Consistently positive item-total correlations, generally between 0,40 and 0,70, indicating that items align well with their intended constructs.

No items showed concerning distributional properties or negative relationships with their own scales.

3.2. Scale-level analyses

Internal consistency was strong across all scales. Cronbach’s alpha coefficients ranged from 0,79 to 0,89 for the DT demands scales and from 0,84 to 0,92 for the resource scales. These values indicate that the scales are reliable. As a general rule, Cronbach’s alpha values above **0,70** are considered good, suggesting that the items within a scale measure the same underlying concept. Values above 0,80 indicate excellent internal consistency, meaning that the items work very well together. Since all scales fall within or above these ranges, the assessment tool shows strong reliability. “Alpha-if-item-deleted” analyses confirmed that no item removal would meaningfully improve scale reliability, indicating stable item functioning.

Mean scale scores indicated meaningful variation across participants:

- Demands were generally moderate (scale means around 2,4-3,6), reflecting mixed levels of technological, individual, group, leadership, and organisational pressure associated with DT.
- Resources were consistently higher (scale means approximately 3,8-4,5), suggesting that respondents perceived a relatively strong supportive environment.

All scale-level statistics are provided in Table 2.

Table 3. Scale level analysis

Scale	Mean	SD	Cronbach's alpha
Technological demands	3,63	0,73	0,85
Individual demands	2,61	0,84	0,89



Group demands	2,72	0,69	0,79
Leadership demands	2,45	0,82	0,88
Organisational demands	2,90	0,77	0,85
Technological resources	3,35	0,68	0,85
Individual resources	3,73	0,60	0,82
Group resources	3,60	0,75	0,88
Leadership resources	3,45	0,79	0,90
Organisational resources	3,30	0,79	0,88

3.3. Inter-scale correlations

The correlation matrix revealed expected patterns consistent with JD-R theory:

- **Demands** were positively correlated with **stress indicators** (burnout and technostress) and negatively correlated with **job satisfaction** and **performance**.
- **Resources** displayed strong positive associations with **job satisfaction**, **task and contextual performance**, and the overall level of DT of the organisation.
- **Resources** were negatively related to **burnout** and **turnover intention**, with moderate to strong correlations (e.g., $r \approx -0,30$ to $-0,50$).

To support interpretation of these results, it is helpful to note that correlation coefficients (r) range from -1 to $+1$. Values closer to $+1$ indicate a strong positive relationship (both variables increase together), whereas values closer to -1 show a strong negative relationship (one increases as the other decreases). In practical terms, correlations of around $0,10$ - $0,30$ are considered small, $0,30$ - $0,50$ moderate, and values above $0,50$ strong. Within this study, demands showed small to moderate correlations with stress indicators, while resources demonstrated moderate to strong links with positive outcomes such as job satisfaction and performance.

Correlations among DT demands and among DT resources also showed a coherent internal structure, with higher associations among similar-level constructs (for example, technological with organisational). At the same time, there were no strong correlations between DT job demands and DT job resources, confirming that these two dimensions are relatively independent. Taken together, the pattern of correlations provides evidence of construct validity and aligns well with theoretical expectations regarding how demands and resources should function. All significant correlations between scales are presented in Appendix 2.



4. DISCUSSION

The aim of this study was to examine whether the digital-era-fit assessment tool functions as expected and whether the results support the underlying conceptual model. Overall, the findings give strong support to the idea that **digital job demands** and **digital job resources** operate as **two separate but complementary aspects** of DT. This provides a foundation for using the tool in organisations to better understand what drives digital stress, digital well-being, and digital maturity.

4.1. DT demands and resources

One of the key conclusions from the correlation analysis is that demands correlate with other demands (for example, organisational and leadership demands: $r = 0,69$), and resources correlate with other resources (for example, leadership and organisational resources: $r = 0,75$). However, correlations between demands and resources are, in most cases, **weak or close to zero**. This confirms that demands and resources are **relatively independent**.

This means that an organisation can be in **any** of the four possible situations:

1. High demands and low resources

This is the most risky combination. Employees are pushed to adapt to new systems and learn new skills while receiving little support. The data shows clear signs of strain:

- DT individual demands are strongly related to technostress ($r = 0,58$) and burnout ($r = 0,38$).
- Job satisfaction goes down when demands rise, especially individual demands ($r = -0,25$).

In such environments, DT may move forward, but at the cost of employee well-being, high turnover, and frequent resistance.

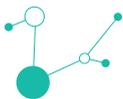
2. Low demands and high resources

This is the most comfortable situation for employees. They feel supported, have the necessary tools, and experience low stress. Resources are linked to positive outcomes:

- Higher job satisfaction (up to $r = 0,38$).
- Higher task and contextual performance (up to $r = 0,46$).
- Lower burnout and turnover intention (around $r = -0,30$).

However, low demands may also signal low ambition or a slow pace of digital change. Organisations may feel safe, but risk falling behind competitors. Also, technological demands, unlike those at other levels, are positively related to performance and the overall level of DT, supporting the hypothesis that low demands in some cases might negatively affect performance and digital progress.

3. High demands and high resources



This combination is common in organisations actively going through DT. People need to adapt quickly and learn new tools, but they are also supported with good leadership, training, and technology. In such settings:

- Resources help balance the pressure of demands.
- DT resources might increase performance (up to $r = 0,46$).
- DT levels are also higher, especially when leadership and organisational resources are strong ($r = 0,54$ and $r = 0,63$).

This is often the ideal environment for innovation, as long as resources keep pace with rising demands.

4. Low demands and low resources

Here, neither pressure nor support is strong. This can feel stable but stagnant. Employees may not experience stress, but digital innovation is unlikely to progress:

- DT positively correlates with technological demands and overall resources, meaning that the lack of these demands and resources will make DT success highly improbable.
- Low resources correlate with lower satisfaction and performance.

Organisations in this situation need to initiate DT changes and activities to survive and keep pace with digital change.

The image below (Figure 6) shows the distribution of the survey participants among four different combinations of DT job demands and resources. It demonstrates that all four situations described above are almost equally common, and organisations in each quadrant will require different measures to boost their digitalisation efforts and maintain employees' digital well-being.

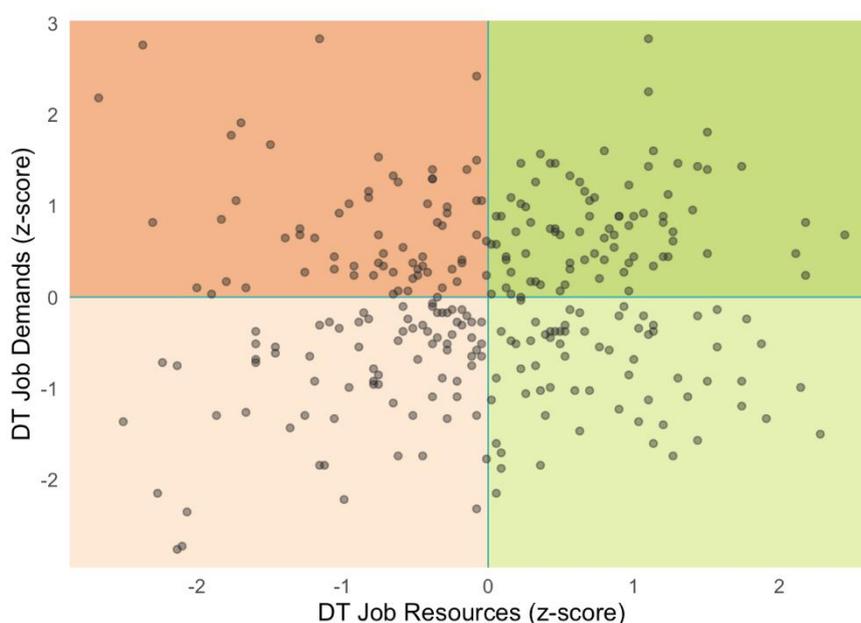


Figure 8. Mapping survey participants by DT demands and resources (standardised scores)



4.2. Other observations

Beyond the main model, several interesting findings stand out.

Individual demands are the strongest predictor of strain. They have the highest links to technostress and burnout, suggesting that personal overload, constant learning, and pressure to multitask are major stressors.

Resources are reliable drivers of satisfaction and performance. Leadership and organisational resources especially stand out as strong predictors of job satisfaction, performance, and DT.

Technological demands are positively related to work performance. It indicates that some optimal level of demands might be needed for people to stay productive, engaged and involved in DT efforts.

These patterns show the value of looking at both sides of the equation, demands and resources, to fully understand how DT affects people and organisations.

4.3. Examples of recommendations

Because DT demands and resources are largely independent, an organisation may face high demands in one area while lacking the resources needed to manage them, or alternatively, may have strong resources that are not matched by corresponding challenges. This makes the digital-era-fit tool particularly useful for diagnosis. Instead of producing a single overall score, it reveals **specific pain points** and **specific strengths** across the technological, individual, group, leadership, and organisational levels. As a result, organisations can identify exactly where digital stress originates and where investment in support, culture, or infrastructure would have the most significant impact. The model, therefore, not only measures the current situation but also allows for providing practical, evidence-based recommendations for improving digital well-being and DT outcomes.

Below, examples of recommendations for the most problematic **“high demands, low resources” quadrant** (upper-left corner of Figure 1) are provided for each of the five demand/resource levels.

Level: Technological | **Quadrant: High Demands + Low Resources**

Employees rely heavily on multiple digital tools, unstable infrastructure, complex security procedures, and fragmented systems. Work is frequently disrupted by technical issues, slow platforms, and a lack of modern hardware or integrated solutions.

Recommendations:

Invest in simplifying and integrating digital systems so employees can perform tasks without switching between platforms or dealing with repeated errors; strengthen infrastructure reliability; and streamline digital security procedures to reduce unnecessary friction. Improving system usability, stability, and integration helps reduce technostress and supports digital performance (*Brink & Packmohr, 2023; Tarafdar et al., 2015*).



Level: Individual | **Quadrant: High Demands + Low Resources**

Employees feel pressured to constantly learn new tools, experience cognitive overload, digital fatigue, worry about their skills becoming outdated, and may fear automation or job loss. Their digital confidence is low, and they lack opportunities and support for upskilling.

Recommendations:

Provide structured learning opportunities during working hours, offer accessible digital skills programmes, and create a psychologically safe environment where employees can experiment and learn without fear. Encouraging continuous development while reducing learning pressure supports well-being and decreases technostress (*Bakker et al., 2023; Li et al., 2025*).

Level: Group | **Quadrant: High Demands + Low Resources**

Teams experience frequent misunderstandings, online communication overload, visible skill differences, frustration around delays, impatience with technical issues, and unclear norms for collaboration. Coordination becomes difficult and interdependencies slow down productivity.

Recommendations:

Establish clear digital collaboration standards, shared communication rules, and regular team check-ins to resolve misunderstandings early. Creating team-level structures and shared practices reduces confusion and helps groups manage the “bright and dark sides” of digital work (*Day & Nielsen, 2017; Scholze & Hecker, 2024*).

Level: Leadership | **Quadrant: High Demands + Low Resources**

Employees experience pressure from supervisors to adopt new tools quickly, face high expectations without guidance, receive limited communication about digital change, and may feel constantly monitored or compared based on how fast they adopt technology.

Recommendations:

Support leaders with training in digital leadership, communication, and change management so they can guide employees through DT more realistically and empathetically. Leaders who are transparent, supportive, and collaborative help reduce stress and build trust (*Hortovanyi et al., 2023; Nielsen et al., 2017*).

Level: Organisational | **Quadrant: High Demands + Low Resources**

Employees experience restructuring, increased administrative load, conflicting old and new systems, rapid strategic changes, and rising workloads without additional support. There is little time to learn new tools and organisational processes feel unstable.

Recommendations:

Align digitalisation with clear organisational processes, provide adequate administrative and technical support during change, and ensure employees have protected time to learn new



systems before they are required in their daily work. Stable strategies and supportive HR structures strengthen digital culture and transformation success (*Mukhopadhyay et al., 2025*).

4.4. Next Steps

Following the results of this approbation study, the next phase of work will focus on refining and strengthening the digital-era-fit model and its assessment tool. One of our first suggestions will be to shorten the questionnaire. Although the current version provides rich diagnostic information, it is relatively long for practical organisational use. Using the psychometric insights obtained in this study, such as item-total correlations, discrimination values, and reliability contributions, we suggest selecting the most effective items and reducing each scale to a more manageable set of five to seven questions. This will make the tool more user-friendly without compromising its diagnostic precision.

In parallel, we propose to develop a dedicated managerial version of the tool. While the existing version focuses on individual employees' experiences, the managerial version will allow supervisors and organisational leaders to assess demands and resources from a broader organisational perspective. This will help bridge employee-level insights with structural and strategic aspects of DT.

Once both versions are finalised, we will pilot the tool across the Central European region. The assessment will be translated into relevant local languages and implemented within the key target groups of the project: SMEs, public institutions, and academic organisations in partner countries. This pilot phase will allow us to test the tool in real organisational environments, gather user feedback, and examine potential cultural or sector-specific differences.

The insights gathered during piloting will guide further refinement of the questionnaire. Based on user feedback, statistical performance, and observed patterns across countries and sectors, we may adjust item wording, clarify concepts where needed, remove underperforming items, and ensure that the final instrument is both psychometrically robust and practically meaningful. Through this iterative process, we aim to deliver a fully validated and user-friendly tool that organisations across the region can use to understand and support digital well-being, readiness, and transformation.



5. CONCLUSION

This deliverable presented the development and initial validation of the digital-era-fit model and its assessment tool, offering a practical framework for understanding how DT creates both demands and resources across the technological, individual, group, leadership, and organisational levels. The findings from the approbation study confirm that demands and resources function as distinct yet complementary dimensions, each shaping employees' well-being and organisational digital maturity in different ways. By providing a multilevel diagnosis of digital pressures and supports, the digital-era-fit tool offers organisations actionable insights into where change efforts are most needed and where strengths can be leveraged. The next stages of the project will refine and pilot the tool across Central Europe, ensuring its relevance, usability, and scientific robustness in diverse organisational settings. This work lays the foundation for evidence-based interventions that help organisations foster healthier, more resilient, and more digitally capable workplaces.



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Appendix 1. Initial set of the digital-era-fit assessment tool items

Demands	Resources
Technological level	
I need to use multiple IT systems and software programs daily to complete my work. (1)	Digital systems in my organisation are well integrated, allowing me to switch between them seamlessly without re-entering data, duplicating work, or creating workarounds. (1)
Because of the nature of my work, I need access to the most effective and up-to-date digital tools (e.g., software, online platforms, data analytics tools) to perform well. (2)	We use high-quality, up-to-date software that meets professional standards. (2)
My work places high demands on the use of AI and automation systems. (3)	A good portion of my manual tasks is effectively automated and streamlined through AI. (3)
My work highly depends on the speed and stability of the internet connection. (4)	The technical infrastructure at my workplace (e.g., internet connection, servers) is stable and reliable, allowing me to work without delays. (4)
My work requires powerful and modern hardware (e.g., computer, laptop, monitor, processor, or other physical devices) as it cannot be done effectively on older or slower equipment. (5)	I have access to powerful and modern hardware (e.g., computer, laptop, monitor, processor, or other physical devices) that allows me to work quickly and efficiently. (5)
My work involves handling sensitive or confidential information, where digital security mistakes can have serious consequences. (6)	The digital systems I use are designed to make security mistakes unlikely and breaches highly improbable. (6)
Even minor technical errors (with hardware or software) can significantly disrupt my work or cause delays. (7)	Built-in safeguards and recovery systems minimise the impact of technical errors on my work. (7)
The digital tools we use make my work more complex and skill-demanding. (8)	New digital tools enable me to accomplish tasks I couldn't do before and move my work forward. (8)
My work requires using multiple digital tools to coordinate collaboration and manage tasks within the team. (9)	The digital tools we use for collaboration and task management are well designed and make teamwork efficient. (9)
Strict security and authentication procedures (e.g., logins, password rules, two-factor authentication) slow down my daily work. (10)	Our IT systems allow me to log in once and securely access multiple platforms without repeated authentication. (10)
Individual level	
I feel pressured to keep learning new digital systems to do my job. (1)	I am confident that I can quickly learn to use a new digital tool. (1)
Learning to use new digital tools takes a lot of my personal time and energy. (2)	I feel confident choosing which digital tools to use and how to use them effectively. (2)
Technological change makes me feel insecure about the relevance of my skills. (3)	I really enjoy learning about new technologies, even when I'm not working. (3)
I struggle to maintain focus and concentration because of frequent digital interruptions and notifications. (4)	I actively look for new ideas or technologies that could make my work more effective. (4)



I feel mentally tired or overwhelmed from processing large amounts of information through digital screens and interfaces. (5)	I feel comfortable experimenting with new digital tools, even if I might make mistakes. (5)
I find it difficult to stay focused and ignore unimportant information when using digital tools (e.g., task managers, messaging apps, email). (6)	I see digital technologies as opportunities to make my work more effective. (6)
I worry that new digital technologies or automation could put me at risk of losing my job. (7)	I am enthusiastic about the learning opportunities created by new technologies. (7)
I am concerned that relying heavily on digital technologies could cause me to lose some of my existing skills or expertise. (8)	I have established clear personal boundaries for responding to work communications. (8)
I fear that my role will become less important as more tasks are automated. (9)	I can disconnect from digital devices when I need to rest or focus. (9)
The rapid pace of digitalisation and AI adoption makes me feel anxious. (10)	I follow healthy screen-time habits (e.g., spending a few hours each day without using screens). (10)
Group level	
We spend extra time resolving misunderstandings that arise from text-based communication (e.g., chat or email) and remote collaboration. (1)	My team has created clear digital workflows so that everyone knows how tasks should be carried out and in what format they should be delivered. (1)
In my team, communication and collaboration happen mainly online, leaving little room for in-person interaction. (2)	We have regular team check-ins to keep everyone updated and to solve problems or misunderstandings. (2)
Team members have very different levels of digital skills, making collaboration on digital tasks challenging. (3)	We have shared online repositories or knowledge bases where important information and documents are easy to find. (3)
My colleagues show impatience when someone has technical issues or struggles to use corporate digital tools quickly. (4)	Team members support each other in learning and using digital technologies. (4)
The volume of team communication through digital channels has increased significantly. (5)	The team fosters members to ask for help with digital tools without judgment. (5)
My work is quite isolated, and I go through long stretches of time without seeing or talking to any of my colleagues. (6)	Clear team agreements define how we use different communication channels for specific purposes. (6)
My colleagues get frustrated if I don't respond to work messages within a few minutes. (7)	I have opportunities to participate in online or offline social activities that strengthen connections within our global team. (7)
Digital tools make it easy for some people to offload tasks onto others without clear accountability. (8)	Our team respects each other's offline time and avoids unnecessary messages outside core working hours. (8)
Cultural or generational differences within my team create tension around digital work expectations and communication styles. (9)	Our team successfully uses digital tools to make workload distribution visible, ensuring fairness and accountability. (9)
My team's online collaboration involves managing complex interdependencies where delays by one person affect everyone else's work. (10)	My team uses shared digital tools that let us work on the same files at the same time. (10)
Leadership level	



My supervisor frequently introduces new digital tools and processes and expects me to learn and use them quickly. (1)	My supervisor ensures that training and support are available when new digital tools are introduced. (1)
I face pressure from leadership to be more technologically skilled and digitally capable while still maintaining traditional processes. (2)	My supervisor involves my colleagues and me in decision-making about digital changes and initiatives. (2)
My supervisor expects me to take initiative in using new technologies without providing detailed direction. (3)	My supervisor has strong digital competencies and leads by example in using new technologies. (3)
My supervisor expects me to answer work emails and messages outside normal working hours. (4)	My supervisor sets aside time to communicate with me, offer support, and provide feedback during digital change. (4)
My supervisor uses digital dashboards and task-tracking systems to closely monitor my progress and requires frequent updates or reports. (5)	My supervisor promptly responds and provides me with timely feedback via digital communication channels (Microsoft Teams, email, or other). (5)
My supervisor emphasises the urgency and importance of digitalisation and digital transformation. (6)	My supervisor provides employees with up-to-date information about digital changes and initiatives. (6)
Unsuccessful attempts to automate or apply new digital tools can negatively affect my performance review with my supervisor. (7)	My supervisor recognises and appreciates employees who take initiative in improving digital practices and adopting new digital tools. (7)
My supervisor evaluates and compares employees based on how quickly they adopt new digital tools. (8)	My supervisor encourages team collaboration and knowledge sharing when learning new digital tools. (8)
My supervisor criticises me or other team members for mistaken or unreliable use of digital tools. (9)	My supervisor allows employees flexibility in how they use digital tools to accomplish their tasks. (9)
My supervisor uses digital tools to monitor when I start and finish work and to check the length or timing of my breaks. (10)	My supervisor encourages employees to experiment with digital tools to improve their task performance. (10)
Organisational level	
My organisation maintains both old and new systems during transitions, forcing employees to follow duplicate procedures. (1)	My organisation has clear policies outlining which IT tools and procedures (digital or paper-based) should be used and when. (1)
The company's digital reporting and documentation requirements add substantial administrative workload. (2)	Our organisation provides sufficient administrative or technical support to help employees manage digital reporting tasks. (2)
My organisation has strict departmental boundaries and/or a rigid hierarchy, which slows down decision-making. (3)	My organisation has policies that enable employees to participate in decision-making about the implementation of new digital tools and processes. (3)
In my organisation, when new digital projects are launched, my regular duties are not reduced, so my overall workload increases. (4)	My organisational policies promote work-life balance and establish the right to disconnect from work communications outside regular working hours. (4)
My organisation introduces new digital projects without providing additional staff to handle the extra work. (5)	My organisation offers employees regular training and development programmes on how to use new digital tools and technologies. (5)
Mistakes or improper use of digital tools at my company can have serious consequences for performance evaluation or compensation. (6)	My organisation's IT and data security teams are well resourced and provide reliable, timely support to employees using digital tools. (6)



My organisation tracks employees' activity in digital systems (e.g., number of tasks completed, time spent online, or response times) to evaluate productivity. (7)	Organisational policies allow employees flexibility in organising their work schedules and choosing work formats. (7)
Digitalisation in my organisation has resulted in restructuring, where some departments have been downsized or merged. (8)	When new digital systems or tools are introduced, my organisation provides employees with enough time to learn how to use them before they are required in daily work. (8)
In my organisation, I am expected to master new technologies while still meeting my usual performance targets. (9)	In my organisation, I am given dedicated time during working hours to learn and practise new digital skills. (9)
My organisation often changes its digital tools or strategic priorities (e.g., switching platforms or redefining key digital projects), which makes it difficult to plan work effectively. (10)	My organisation clearly communicates its strategy, goals, and decisions related to the implementation of new digital tools and processes. (10)



Appendix 2. Inter-scale correlations

	Technological demands	Individual demands	Group demands	Leadership demands	Organisational demands	Technological resources	Individual resources	Group resources	Leadership resources	Organisational resources	Burnout	Technostress	Job satisfaction	Turnover	Task performance	Contextual performance	Digital transformation
Technological demands																	
Individual demands	0,30																
Group demands	0,38	0,54															
Leadership demands	0,41	0,38	0,54														
Organisational demands	0,48	0,43	0,56	0,69													
Technological resources	0,47			0,19	0,12												
Individual resources	0,24	-0,24				0,39											
Group resources	0,40					0,66	0,37										
Leadership resources	0,37					0,59	0,36	0,72									
Organisational resources	0,36	-0,12				0,71	0,40	0,73	0,75								
Burnout		0,38	0,29	0,25	0,24	-0,27	-0,26	-0,14	-0,26	-0,30							
Technostress	0,14	0,58	0,34	0,31	0,34	-0,13	-0,37		-0,13	-0,17	0,60						
Job satisfaction		-0,25	-0,13		-0,14	0,37	0,35	0,25	0,38	0,38	-0,53	-0,38					
Turnover		0,25	0,23		0,27	-0,35	-0,16	-0,18	-0,32	-0,35	0,52	0,34	-0,61				
Task performance	0,19	-0,22	-0,17			0,36	0,26	0,33	0,27	0,37	-0,33	-0,22	0,34	-0,28			
Contextual performance	0,37			0,17	0,14	0,37	0,46	0,29	0,35	0,35	-0,18	-0,16	0,47	-0,21	0,44		
Digital transformation	0,33	-0,17				0,59	0,27	0,55	0,54	0,63	-0,30	-0,17	0,31	-0,32	0,31	0,27	