# Job insecurity and technology acceptance: An asymmetric dependence

Oxana Krutova, Tuuli Turja, Pertti Koistinen, Harri Melin, Tuomo Särkikoski

## Abstract

Purpose: Existing research suggests that the competitive advantage provided by technological development depends to a large extent on the speed and coordination of the technology's implementation, and on how adoptable the technological applications are considered. While accepting this argument, we consider the explanatory model to be inadequate. In this article, we contribute to the theoretical discussion by analysing institutionalised industrial relations and other organisation level factors, which are important for workplace restructuring and societal change.

Design/methodology/approach: Our analysis is based on a representative nation-wide work and working conditions survey (N = 4,100) from Finland, which includes a variety of themes including practices, changes, and wellbeing at work. Changes are understood as organisational changes, focusing on modern technologies such as robotisation and digitalisation.

Findings: Our results indicate that occupational division at workplace (low-skilled vs. high-skilled occupations) affects job insecurity and acceptance of technologies at work. The characteristics of workplaces, such as the employees' participation and involvement in the development of the organisation, play a significant part in both the acceptance and the implementation and outcomes of the technological transformations in the workplace.

Practical implications: The research provides new and interesting insights into working life practices. Furthermore, it reveals how technology acceptance and employment perspectives relate to working conditions and lessons learned from past reforms.

Originality: We consider current theories such as TAM at the micro level and that way rationalize the need for this study. We show the importance of individual, organisational, and wider contextual factors in technology acceptance.

## Keywords

job insecurity, acceptance of technologies, digitalisation of work, industrial relations

## 1. – Introduction

Extensive and diverse research literature suggests that the productivity and competitive advantage provided by technological development depends to a large extent on how quickly the technology is introduced, how effectively it is coordinated, and how well the technological applications are considered. In Finland, it is believed that the high quality of education, heavy investment in R&D, and a successful technology culture will facilitate the implementation of new technologies and promote economic growth (e.g., Koski, 2018; Jalava and Pohjola, 2004; Maliranta, 2005; Koski, 2005). In the Digital Economy and Society Index (DESI), Finland was one of the four Scandinavian countries scoring the highest ratings, indicating them as the most technologized countries in Europe (Eurostat, 2020).

Previous studies suggest that there are good reasons to presume a link between employee involvement and organisational performance, but the relation is not clear-cut. According to Statistics Finland's 2018 Quality of Work Life Survey, 90 per cent of wage and salary earners use digital applications at work. The use of digital devices, personal digital skills, and personal experiences of how digitalisation affects work are, however, distributed unevenly (Official Statistics of Finland, 2021). Different factors, such as organisational structures and employees' opportunities to participate in the design and development of their own work, may complicate this relationship (Litwin, 2011).

There is evidence that the acceptability of reforming work and technological innovations depends on the degree to which the organisations can meet the challenges of these technological changes (see Kimberly and Evanisko, 1981; Helm and Ulhoi, 1996; Clarke, 1997; Litwin, 2011; García-Sánchez *et al*., 2018).

Increasing evidence suggests that these traditional frameworks neglect the realities of implementing technology innovations within organisations and in the interplay between the internal and external structures of the workplace (see Gallivan, 2001; Chau and Tam, 2000; Frambach and Schillewaert, 2002). Technology acceptance models appear to be a typical frame when discussing technological changes in organisations, and these models focus merely on individual perceptions and users' experiences of technology. While we may accept this argument, we still consider the explanatory model to be inadequate, because we do not know so much about the outcomes of digitalisation, considered in terms of workplace restructuring and societal change, e.g., growing labour market polarization and job insecurity.

In this study, we make use of a representative nation-wide work and working conditions survey (N= 4,100) from Finland, which, after decades of data collection waves, now includes sections that concentrate on modern technologies – such as robots, artificial intelligence, and digitalisation – and their impact on the practices of work. By integrating the working conditions survey with the factors of employment survey, the combined data offers enormous opportunities for research. Particularly, the available working conditions survey provides an excellent opportunity to examine the acceptance of new technologies and its link with working conditions, workplace relationships and management, and macroeconomic factors.

In this paper, the aim is ***to examine the extent to which acceptance of technologies at work is associated with job insecurity and occupational division at workplace***. Our main objectives are: (1) to study, what factors drive job insecurity, (2) to investigate, what factors influence technology acceptance, and (3) to classify the effects from labour market dualization considered by occupational

division (low-skilled vs. high-skilled occupations) on job insecurity and acceptance of technologies at work.

The article is structured as follows: we start with the theoretical discussion and review the previous research on job insecurity and workers' acceptance of new technologies at work. After this, we describe the data and empirical analysis methods. Then, we present our research findings along with the empirical and theoretical conclusions.

## 2. – Theory

When explaining adopter attitudes and their innovation-related behaviour, researchers make use of various theoretical frameworks, like the diffusion of innovations (Rogers, 2010), the theory of reasoned action (Fishbein and Ajzen, 1975), the technology acceptance model (Davis, 1989), the theory of planned behaviour (Ajzen, 1985; Taylor and Todd, 1995), and the social-cognitive theory (Compeau and Higgins, 1995). These theories have been widely validated in the case of many technological innovations where individual autonomy is permitted to adopt or reject an innovation (Gallivan, 2001).

To address these issues, the acceptability, adoption, and diffusion of new technologies have been analysed from different theoretical backgrounds. Perhaps too often the focus has been placed separately on individual-level, organisation-level, or societal-level factors. For example, technology acceptance models (Davis, 1989) explain the intention to use technology through functional and social acceptance. Institutional and regulation theories, on the other hand, have examined the impact of legislation and labour relations on the acceptability and implementation of innovations (Jones *et al*., 2005; Blind, 2012). Theories of the diffusion of innovations, in turn, have identified the factors and actors that play a key role in initiating, diffusing, and applying technological innovation (Zoghi *et al*., 2010; Oeij *et al*., 2017).

According to the seminal work on technology and jobs (Braverman, 1974), Theodor Lewis (1996) points out that the basic purpose of introducing technology into workplaces is to foster the transference of skill from labour to capital and to provide the management with greater control over the labour process. In other words, technology engenders a dialectic relation between labour and capital, mediated by the location of skill, with the stakes being workplace power (Foster *et al*., 2019). If this is the case, we suppose then that the relation between workplace organisation and growing job insecurity should be extended towards contextual factors of technology acceptance ***(Hypothesis 1)***.

In companies that are used to conducting organisational and production reforms, employees are better equipped to assess their own position, while in companies where employees are actively involved in product and production process development, employees rely on their own ability to cope with change (Caudiello et al., 2016). Thus, we assume that positive perceptions from technologies at work should also be extended towards contextual factors of technology acceptance ***(Hypothesis 2)***.

In the last few decades, one noticeable change has been a "polarization" of the labor market, in which wage gains went disproportionately to those at the top and at the bottom of the income and skill distribution (Autor, 2015; Scarpello and Carraher, 2008). On the basis of previous studies (Lee *et al*., 2009; Wahdain & Ahmad, 2014; Mlekus *et al*., 2020), we assume that workers' subjective experiences and views on industrial relations and their labour status in the workplace indicates their attitudes towards technologies at work. We assume that occupational division at workplace and possibilities of usage of technologies at work will affect acceptance of technologies ***(Hypothesis 3)***.

## *2.1. – Job insecurity in the workplace*

The concept of job insecurity was first formulated by Greenhalgh and Rosenblatt (1984, p.438) as "the perceived powerlessness to maintain desired continuity in a threatened job situation". In the last decades, the discourse about job insecurity has been redirected to analysis of the meaning

of organizational change on job insecurity. As numerous studies have shown, organizations perform in contradictory ways because they must satisfy the environmental and organizational conditions under which each form of intrafirm competition is expected to occur (Birkinshaw and Lingblad, 2005), e.g., during downsizings (Fairhurst *et al*., 2002) or in the microprocesses of institutional complexity (Blomgren and Waks, 2015). We suppose that perceived job insecurity will be related to major organisational changes and shaping the ways of doing work with technologies or using artificial intelligence (***Hyp.1a***).

There is limited research on whether poor labor market conditions influence the degree that employees' perceptions of the future of work and employment are distressing. As Glavin and Young (2017) have shown, high unemployment levels are associated with increased perceptions of job insecurity among the employed and the threat to their continuing employment. We suppose that perceived job insecurity will be related to the threat of redundancy (e.g., higher risks of dismissal and lay-off) (***Hyp.1b***).

In the process of intensive organizational changes of the company, employees and managers' collective values being inconsistent and contradictory can also cause radical changes both in the environment and in the organization itself (Janicijevic, 2017). Competition and technologies are likely to have affected motivational policy of organizations, leading to declining organizational commitment and employers' re-orientation on the implicit bargain policy with older employees (White, 2012). Job insecurity is negatively associated with job involvement and career satisfaction and positively with readiness to make concessions and strain (Otto *et al*., 2011). We suppose that perceived job insecurity will be related to growing contradictions at workplace between employees and employers (***Hyp.1c***).

Among those studies, analysis of organizational changes is dominating, however, the interpretations of roles of involved actors are somehow neglected. Another aspect is a distinction between the business justification for encouraging diversity in the workforce and the human rights

justification for discrimination (Sargeant, 2005). This is especially important because there is a close relationship between discrimination on the grounds of age sex, race, disability, and growing job insecurity at workplace. We suppose that perceived job insecurity will be related to discrimination by supervisors (***Hyp.1d***).

As numerous studies have shown, digitization has affected the workload of staff in preservation departments as the number of items processed by preservation departments has increased by ten percent due to digital-reformatting tasks (Kennedy, 2005). A platform approach leverages the value of digital and information technologies (e.g., smart and connected machines) for advanced service offerings in manufacturing firms (Cenamor *et al*., 2017). We suppose that perceptions of technologies and digitalisation will be related to workload and work efficiency (***Hyp.2a***).

Lean global start-ups benefit from the use of digital technologies by optimizing decision-making processes including the ability to make long-term, strategic decisions due to better market information (Neubert, 2018). We suppose that perceptions of technologies and digitalisation will be related to opportunities for employees' own development and participation in development of own work organisation (***Hyp.2b***).

The landscape and nature of knowledge work is changing due to digitalization: even though knowledge workers gain several benefits from digitalization, the effects of opposite, value destroying factors, are still stronger (Vuori *et al*., 2019). Some jobs are at risk of computerization and the relationship between an occupations' probability of computerisation, wages and educational attainment can be disproportional (Frey and Osborne, 2017). The significance of new technology to unskilled work in the public sector is central to job change (Munro and Rainbird, 2002). We suppose that perceptions of technologies and digitalisation will be related to job mobility of employees (change for another job for the same salary, opportunities to get a new job) (***Hyp.2c***).

### *2.2. – Determinants of technology acceptance in the workplace*

There are critical concerns about the role of technological unemployment and internal divisions within the world of work. At the level of the organisation, one must consider how the practices in the workplace and the workers' past experiences of technological innovations affect the acceptance of innovations in the workplace and the workers' perceptions of the future of work and employment. We suppose that the threat of layoffs, dismissal, or unemployment, will be associated with job insecurity (***Hyp.3a***) and to a minor extent with perceptions of technologies and digitalisation (***Hyp.3b***).

These arguments lead us back to the classical issues of industrial relations analysis and we believe that there is a dependence between loyalty and technological acceptance. However, how much does the employees' loyalty towards the employer vary between organisations, and what about the reciprocal dependencies (Dockel *et al*., 2006; Šajeva, 2007)? Employers who invest in workers' wage and skill development expect a return and behave accordingly. On the other hand, workers who do their best in order to adapt to the changing conditions of work in times of economic booms expect the employer to remember their inputs and loyalty and to respect the workers' rights and interests in times of economic hardships (Lewis *et al*., 2016; Saiz, 2009; Pearson *et al*., 2013).

The relation between organisational practices and workers' behaviour has been noted directly and indirectly in many empirical studies and in various contexts. For example, Ann Bartel and Nachum Sicherman (1999) have explored the link between technological changes at the company level and employee retirement plans. They showed that employees are more likely to retire in those companies that were not accustomed to continuous technological innovations and, consequently, job changes. Using the 1966–1983 National Longitudinal Surveys of Older Men in the USA, they found that it is important to distinguish between long-term variations and unexpected changes in industry rates of technological change. Workers in manufacturing industries with higher average rates of

technological change retire later than workers in industries with lower rates of technological change, and an unexpected increase in the rate of technological change induces earlier retirement, especially among workers aged 65 and older (Bartel and Sicherman, 1999). We suppose that unforeseen changes, increasing workload, moving job to another location will be associated with job insecurity (***Hyp.3c***) and to a minor extent with perceptions of technologies and digitalisation (***Hyp.3d***).

Bartel and Sicherman (1999) found that production workers in manufacturing industries with higher rates of technological change are significantly more likely to receive formal company training, which is consistent with the notion that technological change makes previously acquired skills obsolete, thereby inducing workers and firms to invest in training to match the specific requirements of the latest innovations. Using data from 21 industrial countries from the period 1985–2009 and a large number of controls, Horst Feldmann (2013) analysed the impact of technological change on unemployment. His results indicate that a rapid technological change is likely to increase unemployment substantially, but the adverse effect appears to persist for three years and to disappear afterwards. In regard to this finding, it is interesting that the effect is transitory rather than permanent.

The results lend support to the theoretical contributions (Schumpeter, 1912) that argue technological progress may increase unemployment, at least during a transition period. On the basis of these results, one could conclude that the time pattern of the effect on unemployment should be studied in more detail. We suppose that the fear that human labour can be replaced by technology in the near future or the knowledge about technologies at work is not enough will be associated with job insecurity (***Hyp.3e***) and to a minor extent with perceptions of technologies and digitalisation (***Hyp.3f***).

The literature on organisations and innovations suggests that industrial relations at the organisational level have a strong effect on technological improvement (Günday *et al*., 2011; Lenart-Gansiniec, 2019). In such organisations where employees are well informed and have a voice in the development work, workers feel loyalty and responsivity to the further development and competitiveness of their workplace (Beblavý *et al*., 2012). This loyalty may contribute to efficiency

and consumer relations: the organisation can meet the customers' expectations because the workers have information about consumer preferences and constraints that the managers do not have (Zoghi *et al*., 2010). Similarly, workers who have participated in the production process will learn about the weaknesses and inefficiencies of the innovation process. In cases where workers have opportunities to share information about the weaknesses and inefficiencies of the innovation process, subsequent innovations will more likely respond to these preferences or weaknesses (Zoghi et al., 2010; Beblavý et al., 2012).

There is significant evidence in organisational studies of a strong link between employee participation and organisational success. However, this link is not straightforward or causal. There are various factors, like organisational structures and the opportunities of employees to participate in the design and development of their own work, which complicate this relationship (Litwin, 2011). Continuing this line of argumentation and pinpointing some important qualitative aspects of the workplace – like trust and overcoming risk aversion and a lack of information – organisations can make use of the promises of technological advancement and overcome the barriers and uncertainty (see Beblavý *et al*., 2012). We suppose that employee engagement and commitment (the atmosphere at workplace is encouraging, there is enough discussion about work organisation or problems in workplace, workplace appreciates the work experience of older employees, competition in work unit is high) will be associated with perceptions of technologies and digitalisation (***Hyp.3h***) and to a minor extent with job insecurity (***Hyp.3g***).

# 3. – Data and methods

## *3.1. – Data*

In our analysis, we use the 2018 Quality of Work Life Survey. The Quality of Work Life Survey is a broad-based national interview survey of Statistics Finland that has been conducted since 1977. The survey widely studies wage and salary earners' physical, mental, and social work environments and

gathers data on contents of work, labour market status, terms and conditions of employment, reconciliation between work and family life, occupational health, and factors at the work organisation level. The sample is drawn from face-to-face interviews using a standardised questionnaire and web data collection of the Labour Force Survey The sample size of the survey varies from 3,800 to 7,000 persons.[1]

We use the Quality of Work Life Survey data from the latest survey, that is, 2018 (N = 4,109). Statistics of Finland was reviewed the questionnaire 2018 in connection with each survey round and new questions have been added to it for examining topical new working life occurrences due to digitalisation of work. The 2018 data includes the issues of the digitalisation of work and usage of technologies at work as well as workers' experiences of the usage of digitalisation and technologies at work.

We created separate samples for ***high-general-skill occupations*** (managers, professionals, technicians, and associate professionals), and ***low-general-skill occupations*** (specific skill occupations, e.g., clerical support, service workers, and elementary occupations) in workplaces with or without technologies at work.

## *3.2. – Methods and analysis*

Based on existing literature on the topic, we have chosen from the 2018 Quality of Work Life Survey the measures describing job insecurity, workers' experiences of the usage of digitalisation and perceptions of the future of work and employment. Initial tests were conducted for 32 reflective indicators in order to ensure that the measures chosen for the analysis correlated highly. A full description of the indicators is shown in Supplementary material.

[1] Official Statistics of Finland (OSF): Quality of work life [e-publication].
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Access method: http://www.stat.fi/til/tyoolot/tyoolot_2018-01-04_uut_001_en.html

We carried out the exploratory factor analysis based on iterated principal factors and oblique promax rotation (Kaiser). The results of the factor analysis showed that two of the reflective indicators had relatively low loadings (<0.4) with their corresponding construct. Therefore, removing these two indicators with low loadings would improve the quality and predictive relevance of the structural model. Consequently, we removed the following indicators one at a time: CWP5 and PEF10.

Factor analysis allowed to classify 30 reflective indicators into three factors, which we named as 'job insecurity in the workplace' (Factor 1), 'experiences of technological innovations' (Factor 2), and 'employees' perceptions of the future of work and employment' (Factor 3).

'Job insecurity in the workplace' (Factor 1) was measured with nine items from the validated research of Janicijevic (2017) (e.g. 'Has your workplace undergone major organisational changes in recent years, or is it about to happen?'), Autor (2015) ('Has the way you work with robotics or artificial intelligence, etc. changed?'), Fairhurst et al. (2002) ('Has workplace in your organisation been made redundant in the last three years?', 'Have workers been laid off in the last three years?', 'Have workers been made redundant (dismissed) in the last three years without being replaced?'), Blomgren and Waks (2015) ('How many conflicts do you have between your supervisor and your subordinates in your work unit?', 'How many conflicts do employees have in your work unit?'), and Sargeant (2005) ('Discrimination by supervisors').

'Employees' experience of technological innovations' (Factor 2) was used as a comprehensive and specific indicator of the acceptability of new technologies. The scale included seven items. Example items are based on the work of Neubert (2018) ('How has digitalisation affected the speed of work?'), Kennedy (2005) ('How has digitalisation affected the workload?'), Cenamor et al. (2017) and Vuori et al. (2019) ('How has digitalisation affected work efficiency?'), Matt et al. (2019) ('What opportunities do you have in your current workplace to develop yourself?'), Knudsen et al. (2011) ('In your current job, do you have good or weak opportunities to contribute to the development of your own work organisation?'), Scarpello and Carraher (2008) ('If you could change

to another job for the same salary, would you change?'), and Bakker et al. (2012) ('What opportunities do you think you would have to get a new job?').

In order to assess the outcomes of technology acceptance, we estimated 'employees' perceptions of the future of work and employment' (Factor 3) and used 16 items combined on the basis of previous research. In particular, we used the studies of Glavin and Young (2017) and Otto et al. (2011) (e.g. the threat to be laid off, dismissed, unemployed, disabled), Frey and Osborne (2017) ('Your input is no longer needed because it can be replaced by technology in the near future'), Munro and Rainbird (2002) ('You don't learn to use new technology well enough'), Grolleau et al. (2013) ('Is the atmosphere in our workplace encouraging?'), Arvanitis and Loukis (2009) ('Is there enough discussion about work organisation or problems in our workplace?), White (2012) ('Does our workplace value the work experience of older employees?'), and Birkinshaw and Lingblad (2005) ('How much competition is there in your work unit?').

We have used the Stata 12.0 programme for structural equation modelling for path models. Structural equation modelling (SEM) is a comprehensive statistical modelling tool for complex relationships between multiple independent and dependent variables (Acock, 2013). A path model represents a causal model that contains exogenous variables, endogenous outcome variables, and endogenous mediator variables. We have chosen the measurement model through path analysis, which allows to determine whether the observed variables are good indicators of the latent variables. Therefore, we carried out separate path analysis models for each set of observed variables hypothesised to indicate their respective latent variable. We utilised the method of Maximum Likelihood with missing values for the proposed model.

## 4. – Results

### *4.1. – Structural Equation Models: occupational factor in technology acceptance*

Tables I show the standardised coefficients as those presented in the structural equation models (see Figures 1–4 in Annex).

<Table I about here>

We found that major organisational changes and the threat of redundancy have the highest significance for job insecurity in the workplace and to the major extent for *low-general-skill occupations using technologies at work* (***Hyp.1a*** and ***1b***). We also found that perceived job insecurity is related to growing contradictions at workplace between employees and employers (***Hyp.1c***) and discrimination by supervisors (***Hyp.1d***) and it is important for all the groups except for those in *high-general-skill occupations using technologies at work*.

Our results indicate that perceptions of technologies and digitalisation are related to workload and work efficiency (***Hyp.2a***) for all the groups and to a major extent those in *high-general-skill occupations that use technologies at work*. We also found that perceptions of technologies and digitalisation are related to opportunities for employees' own development and participation in development of own work organisation (***Hyp.2b***) and job mobility of employees (***Hyp.2c***) and are important for all the groups except *low-general-skill occupations using technologies at work*.

Table II contains the estimation of the indirect effects in relation to interdependence between the factors. One should notice that *low-general-skill occupations that do not use technologies at work* is an exceptional group, because the analysis was not able to estimate the indirect effects for this group due to absence of path (causal) interdependence between the three factors. Instead, the covariance between the three factors has been estimated.

<Table II about here>

When estimating the indirect effects, we accounted for the interdependence between the 30 reflective indicators and three factors. We found that the outcomes of technology acceptance driven by job insecurity (***Hyp.3a, 3c, 3e*** and ***3g***) are pronounced only for *high-general-skill occupations that do not use technologies at work* and, to a major extent, for *low-general-skill occupations that use*

*technologies at work*. On the contrary, we found that the outcomes of technology acceptance driven by positive perceptions of technologies and digitalisation (***Hyp.3b***, ***3d***, ***3f*** and ***3h***) are pronounced only for *high-general-skill occupations that do not use technologies at work* and, to a major extent, for *high-general-skill occupations that use technologies at work*.

## 5. – Discussion

The article provides new and interesting insights into working life practices and the way technology acceptance and employment perspectives relate to working conditions and lessons learned from past reforms. We compared organisations using vs. non/using technologies at work and present the summarised results in Table III.

<Table III about here>

The results indicate differences between the groups of observations that were under comparison: use/non-use of technologies at work and low-skilled/high-skilled occupations. We found a direct effect from the threat of unemployment upon employees' perceptions among workers with low-general-skill occupations when technologies are used in the workplace. On the other hand, the threat of redundancy due to the implementation of new technology is important in organisations using or non-using technologies at work. This was particularly evident among those in low-general-skill occupations working in workplaces with technologies at work.

Our results confirm the earlier findings about the negative impact of the perceived risk of unemployment and support their relevance also in the case of workplace with technologies at work. Otto et al. (2011) considered a flexible mindset a potential moderator between individuals' job insecurity and job involvement and career satisfaction. The more flexible individuals experienced less health impairment when perceived (quantitative) job insecurity and regional unemployment were high. On the other hand, Glavin and Young (2017) have argued that the health penalties of job insecurity are weaker for individuals in high-unemployment regions, which can be explained by the

ability of insecure workers in poor labour market contexts to retain the psychological resources important for protecting mental health.

There has been widespread debate over labour input being no longer needed due to future replacement by technology. For example, Frey and Osborne (2017) found that jobs susceptible to computerisation are those that use routine labour. Autor (2015) has discussed the interplay between machines and humans. According to him, a comparative advantage allows computers to substitute for workers performing routine, codifiable tasks while amplifying the comparative advantage of workers in supplying problem-solving skills, adaptability, and creativity.

Conflicts in the workplace continue to weaken the acceptance and positive perceptions of technologies. However, in those workplaces where the employees are well informed and involved in the local industrial relations systems, the majority of these problems disappear. Blomgren and Waks (2015) have suggested that a new type of soft actor – the hybrid professional – is likely to be influential in organisations characterised by institutional complexity. The reason for this is found in the character and work of the hybrid professionals: an important part of their work is to construct problems and solutions that align with all the logic at play.

When it comes to conflicts between managers and workers, our results show that they were present and important for all groups except for high-general-skill occupations using technologies at work, and to a major extent is it more important for workplaces where technologies are not used at all. Grolleau et al. (2013) have noticed that firms in which employees report a good workplace atmosphere are more likely to engage in innovation activities. Arvanitis and Loukis (2009) found statistically significant positive effects for physical capital, ICT capital, human capital, and "employee voice"-oriented organisational practices on labour productivity. Employees who have in the past received relatively favourable treatment from employers in their later careers have probably the long-term employment relationship; competition and technologies are likely to have affected the motivational policy of employers (White, 2012).

The role of technologies therefore makes sense in decreasing contradictions in the workplace for workers with a higher degree of professional competence. These results are in line with previous studies underlining production workers in manufacturing industries with higher rates of technological change and who are more likely to receive formal company training (Bartel and Sicherman, 1999; Zoghi *et al*., 2010; Beblavý *et al*., 2012).

On the contrary, we found that low-general-skill occupations using technologies at work are at a higher risk of experiencing contradictions at work due to organisational changes. Earlier research (Janicijevic, 2017) suggests that the values of both the employees and the managers may be contradictory, and this contradiction is caused by radical changes in the environment and in the organisation itself. Therefore, an absence of high professional competence can presumably affect adaptation to organisational changes, which are a natural part of the organisation's development.

In terms of the 'employees' experience of technological innovations' (Factor 2), the results indicate that the influence of digitalisation on the speed of work is important especially for high-general-skill occupations using technologies at work. Due to digitalisation job content of workers having the higher level of education becomes more complicated (cf. Kennedy 2005). The number of items processed by ICT departments has increased by ten per cent because of digital-reformatting tasks without a corresponding increase in staffing. A platform approach based on a modular architecture can enable manufacturers to pursue both customisation and operational efficiency as the core modules for successful servitisation (Cenamor *et al*., 2017).

The group of high-general-skill occupations using technologies at work seems to have a higher positive experience of digitalisation. Users typically make their own decisions over which technologies they will use, as well as when and how they will use them, and they are responsible for the cost of the technologies and their use (cf. Matt *et al*., 2019). As Bakker et al. (2012) have noted, employees characterised by a proactive personality are most likely to craft their jobs – that is, to increase their structural and social job resources and increase their job challenges. Job crafting, in

turn, is predictive of work engagement – vigour, dedication, and absorption – and colleague ratings of in-role performance. To the extent that employees proactively adjust their work environment, they manage to stay engaged and perform well. Work environment quality and high levels of participation go hand in hand: within a typology of participation models, the highest level of participation – including strong elements of collective participation and also the best work environment measured as 'psychosocial well-being' – were found in workplaces managed in accordance with democratic principles (see Knudsen *et al*., 2011).

The Finnish working conditions survey is a high-quality dataset by international standards, but there are still remarkable shortcomings in the research and data. Further improvements in the data collection and validations are needed to improve our understanding of how the quality of work, worker status, work relationships, and previous experiences of employment risks at work might contribute to the acceptance of technologies. Vice versa, the same is true of how the acceptance of technologies is boosting innovations and work productivity. In order to make this happen, we believe that research on technology acceptance should expand its focus from the technical capabilities of technologies and turn to designing broader situated human–technology interaction systems (Šabanović and Chang, 2016). Attention and critical studies should focus on evaluating the development of social structures that support, limit, and enable the appropriate use of technologies at work. This also requires similar developments in data production.

This kind of argumentation leads us to a wider framing of research and to look at the options for advanced statistical methods, like structural equation modelling, which enable us to integrate the various factors into the same statistical model and determine their interplay in causal reasoning. We expect that such a multi-level analysis will provide a more reliable – and politically relevant – theoretical frame to analyse the development of technological reforms, as well as the potential for steering them. To improve the reliability of the results, the effects of technologies at work and employment should be studied in the long run and across industrial sector.

## 6. – Conclusion

Previous research concerning technology acceptance is rich and comprehensive, but it has not taken into account the fact that the acceptability of new technologies in workplaces depends on the degree to which organisations have the skills to meet the challenges of these innovations. The use of new technologies at work is a complex issue. It is not only the attitudes, skills, or the threat of unemployment that matter; confidence, and other contextual issues are also important. In this article, we have taken into account these contextual and institutional factors.

The characteristics of workplaces – such as employees' opportunities to participate and be involved in the development of the organisation – are important. The organisational culture influences the acceptance, implementation, and outcomes of the technological transformations in the workplace. Given that both high-skilled and low-skilled employees are sensitive to their treatment in the organisation, there are significant differences between those workplaces already using technologies and those that do not use technologies at work. On the one hand, employees with low skills may not even use technologies at work. On the other hand, highly skilled employees are using technologies at work and interact with new technologies every day: technologies are an elementary part of their work. In this case, industrial relations in the workplace have great significance.

All of this can be summarised as follows: technology does not act alone; it is mediated by human work and decisions. People run organisations and ultimately determine what we get as a result of implementing new production or service technologies. Our results suggest that the implementation of new technologies is the key issue, and the way in which technologies or new digital platforms are implemented has a great impact on the whole production process. There should be an open dialogue between the management and the employees about the consequences of new technologies, which would greatly contribute to integration of employee's at workplace.

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# 8. – Annex

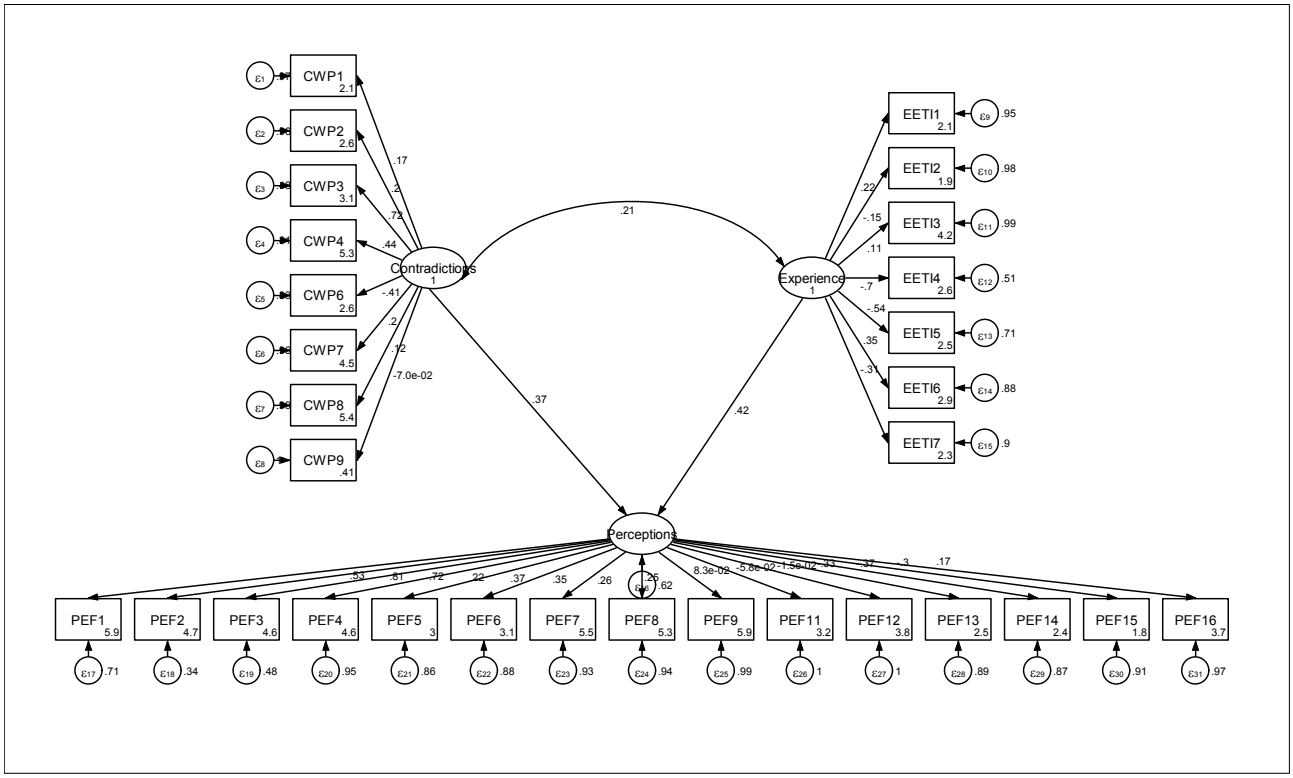


*Figure 1. SEM for high-general-skill occupations that use technologies at work ($X^2(402)=1027.339$; $p<0.001$; RMSEA=0.075; CFI=0.476; N=277).*

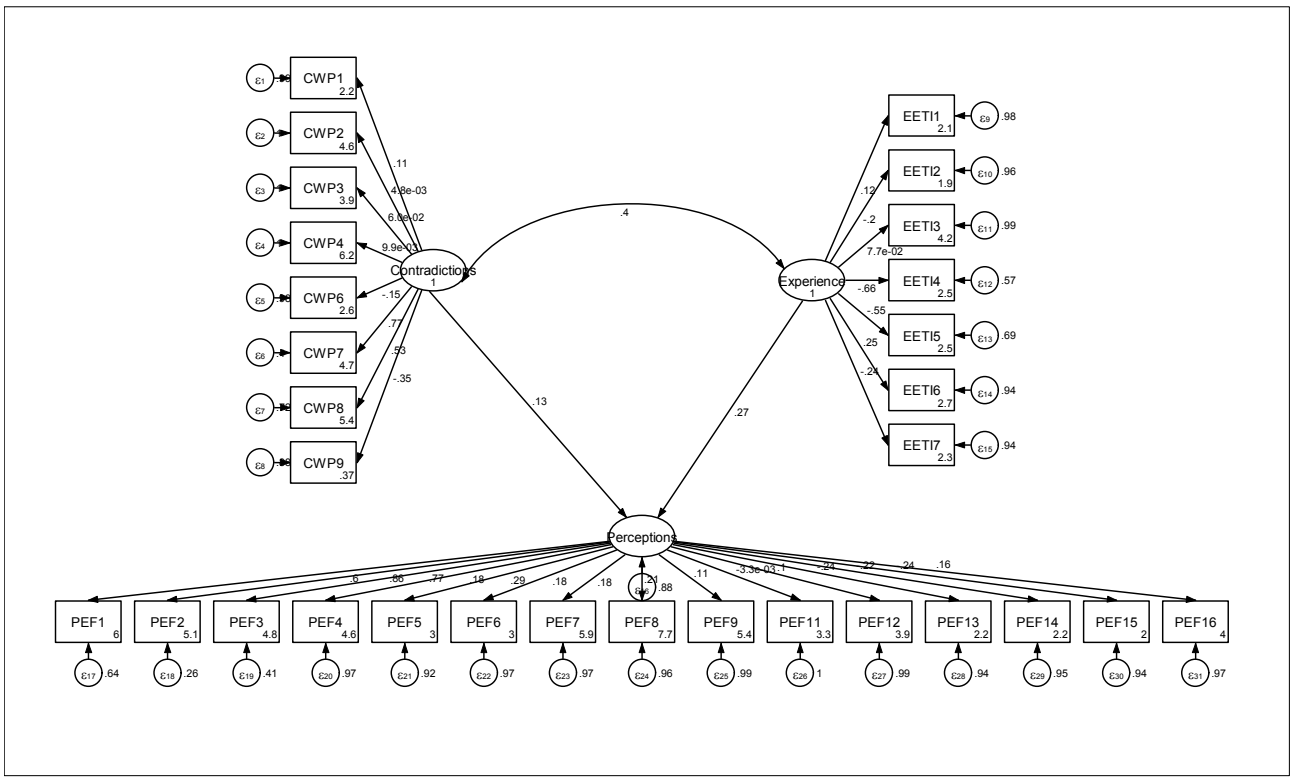


*Figure 2. SEM for high-general-skill occupations that do not use technologies at work ($X^2(402)=4952.041$; $p<0.001$; RMSEA=0.076; CFI=0.455; N=1974).*

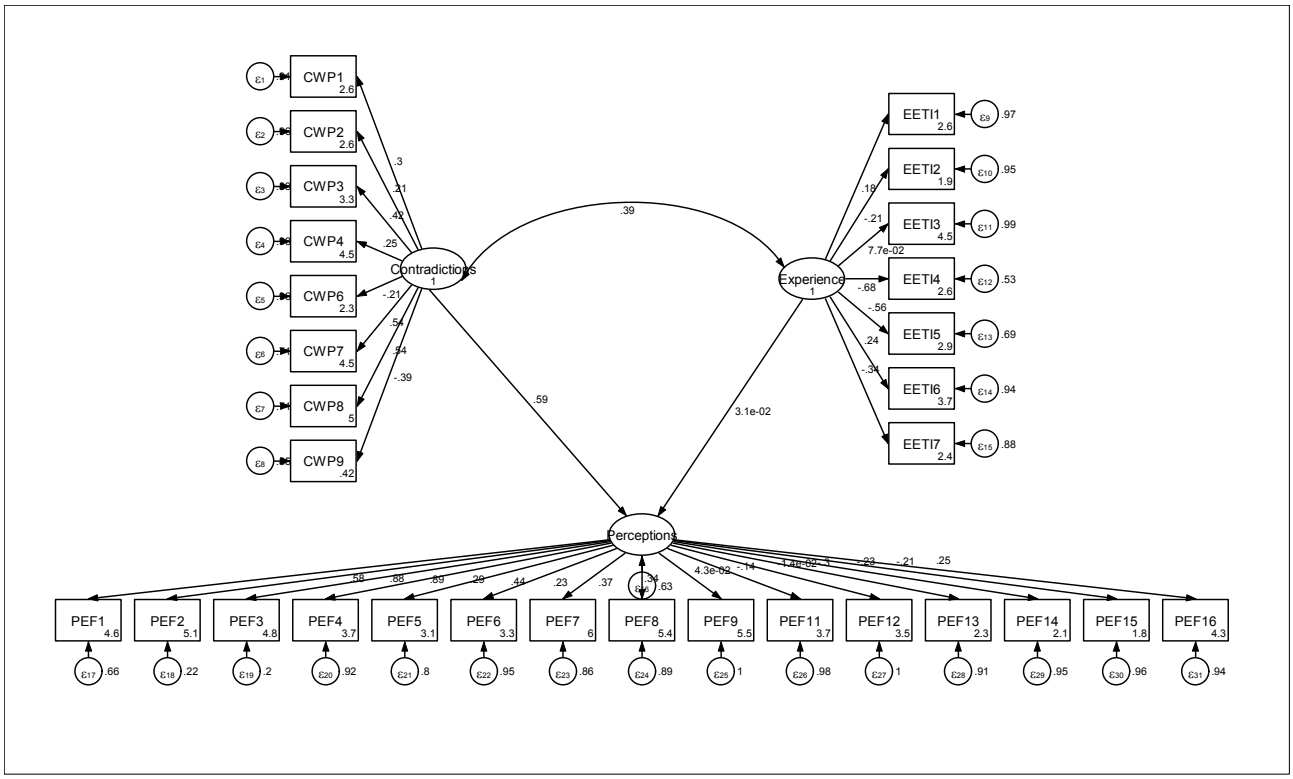


*Figure 3. SEM for low-general-skill occupations that use technologies at work ($X^2(402)=1069.514$; $p<0.001$; RMSEA=0.080; CFI=0.531; N=258).*

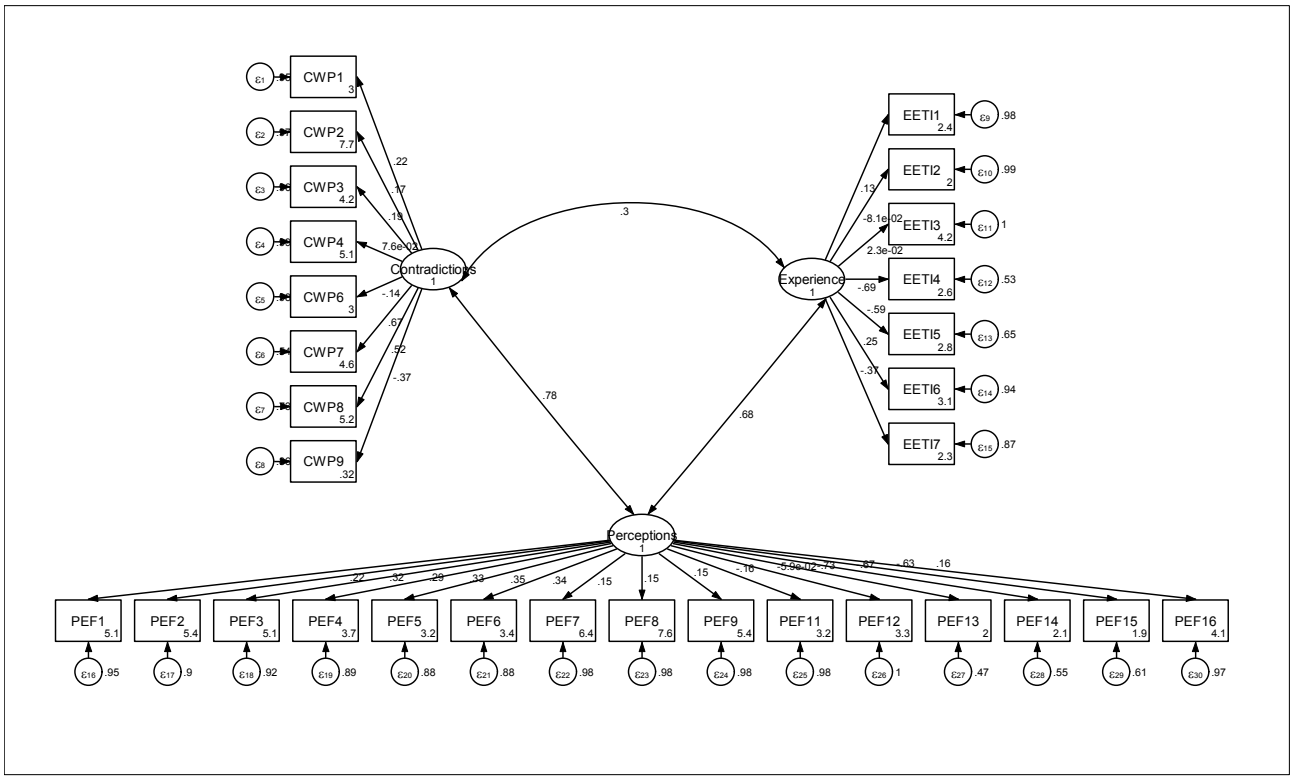


*Figure 4. SEM for low-general-skill occupations that do not use technologies at work ($X^2(402)=3972.524$; $p<0.001$; RMSEA=0.075; CFI=0.500; N=1580).*

## Tables in the text

Table I. The direct effects estimated for four groups of observations (OIM, Std. coefficients (P>z in asterisks)).

| | | High-general-skill occupations & technologies are present | High-general-skill occupations & technologies are not present | Low-general-skill occupations & technologies are present | Low-general-skill occupations & technologies are not present |
|---|---|---|---|---|---|
| Job insecurity | CWP1 Other major organisational changes? | 0.168*** | 0.112*** | 0.297*** | 0.221*** |
| | CWP2 Changing the ways of doing work with technologies or using artificial intelligence, etc.? | 0.200 | 0.004 | 0.205* | 0.171*** |
| | CWP3 Redundant? | 0.120* | 0.060 | 0.418** | 0.194*** |
| | CWP4 Laid off? | 0.435 | 0.009 | 0.254* | 0.076* |
| | CWP6 Has the number of employees at your location changed in the last three years? | -0.407 | -0.145*** | -0.211* | -0.142*** |
| | CWP7 How many conflicts do you have between your supervisor and your subordinates in your work unit? | 0.204 | 0.772*** | 0.537*** | 0.674*** |
| | CWP8 How many conflicts do employees have in your work unit? | 0.115 | 0.531*** | 0.535*** | 0.517*** |
| | CWP9 Discrimination by supervisors. | -0.070 | -0.351*** | -0.393** | -0.369*** |
| Experience | EETI1 How has digitalisation affected the fast pace of work? | 0.220*** | 0.123*** | 0.180*** | 0.133*** |
| | EETI2 How has digitalisation affected the workload? | -0.150 | -0.196*** | -0.212 | -0.081 |
| | EETI3 How has digitalisation affected work efficiency? | 0.111 | 0.076* | 0.077 | 0.022 |
| | EETI4 What opportunities do you have in your current job to develop yourself? | -0.699** | -0.658*** | -0.684 | -0.689*** |
| | EETI5 In your current workplace, do you have good, some, or poor opportunities to participate in the development of your own work organisation? | -0.536* | -0.553*** | -0.559 | -0.592*** |
| | EETI6 If you could change to another job for the same salary, would you change? | 0.351* | 0.251*** | 0.235 | 0.254*** |
| | EETI7 What opportunities do you think you would have to get a new job? | -0.313* | -0.241*** | -0.340 | -0.367*** |
| Perceptions | PEF1 The threat of layoffs? | 0.534*** | 0.600*** | 0.582*** | 0.224*** |
| | PEF2 Threat of dismissal? | 0.811*** | 0.858*** | 0.881*** | 0.323*** |
| | PEF3 The threat of unemployment? | 0.719*** | 0.768*** | 0.891*** | 0.286*** |
| | PEF4 The threat of incapacity for work? | 0.217** | 0.179*** | 0.291*** | 0.327*** |
| | PEF5 Unforeseen changes? | 0.370*** | 0.288*** | 0.444*** | 0.350*** |

| | | | | | |
|---|---|---|---|---|---|
| | PEF6 Increasing workload over tolerance? | 0.352*** | 0.178*** | 0.230*** | 0.341*** |
| | PEF7 Moving job to another location? | 0.258*** | 0.177*** | 0.367*** | 0.153*** |
| | PEF8 Your input is no longer needed because it can be replaced by technology in the near future? | 0.247*** | 0.206*** | 0.336*** | 0.151*** |
| | PEF9 You don't learn to use new technology well enough? | 0.083 | 0.106*** | 0.042 | 0.147*** |
| | PEF11 Have you changed jobs in the last 5 years? | -0.058 | -0.003 | -0.136* | -0.157*** |
| | PEF12 Have you been unemployed or laid off in the last 5 years? | -0.014 | -0.103*** | -0.014 | -0.058* |
| | PEF13 Is the atmosphere in our workplace encouraging? | -0.327*** | -0.239*** | -0.296*** | -0.731*** |
| | PEF14 Is there enough discussion about work organisation or problems in our workplace? | -0.367*** | -0.216*** | -0.228*** | -0.668*** |
| | PEF15 Does our workplace value the work experience of older employees? | -0.295*** | -0.238*** | -0.206** | -0.625*** |
| | PEF16 How much competition is there in your work unit? | 0.168* | 0.162*** | 0.250*** | 0.162*** |
| Covariance between Perceptions and Job insecurity | | 0.367 | 0.131** | 0.591** | 0.783*** |
| Covariance between Perceptions and Experience | | 0.423* | 0.267*** | 0.031 | 0.675*** |

Notes: The significance levels (based on the *z* tests) shown here are for the unstandardised solution, because the specific *z* tests for the indirect and direct effects are not provided in the standardised solution (Acock, 2013, p. 76).
***p < .001, ** p < .01, * p < .05.

Table II. The indirect effects estimated for four groups of observations (OIM, Std. coefficients (P>z in asterisks)).

| | | high-general-skill occupation & technologies are present | high-general-skill occupations & technologies are not present | low-general-skill occupations & technologies are present | low-general-skill occupations & technologies are not present |
|---|---|---|---|---|---|
| PEF1 Threat of layoffs? | Perceptions | - | - | - | - |
| | Job insecurity | 0.196 | 0.079** | 0.344** | - |
| | Experience | 0.226* | 0.160*** | 0.018 | - |
| PEF2 Threat of dismissal? | Perceptions | - | - | - | - |
| | Job insecurity | 0.298 | 0.113** | 0.521** | - |
| | Experience | 0.343* | 0.229*** | 0.027 | - |
| PEF3 Threat of unemployment? | Perceptions | - | - | - | - |
| | Job insecurity | 0.264 | 0.101** | 0.527** | - |
| | Experience | 0.304* | 0.205*** | 0.028 | - |
| PEF4 Threat of incapacity for work? | Perceptions | - | - | - | - |
| | Job insecurity | 0.079 | 0.023** | 0.172* | - |
| | Experience | 0.092 | 0.047** | 0.009 | - |

| | | | | | |
|---|---|---|---|---|---|
| PEF5 Unforeseen changes? | Perceptions | - | - | - | - |
| | Job insecurity | 0.136 | 0.038** | 0.262** | - |
| | Experience | 0.156* | 0.077*** | 0.013 | - |
| PEF6 Increasing workload? | Perceptions | - | - | - | - |
| | Job insecurity | 0.129 | 0.023* | 0.136* | - |
| | Experience | 0.149* | 0.047** | 0.007 | - |
| PEF7 Moving job to another location? | Perceptions | - | - | - | - |
| | Job insecurity | 0.095 | 0.023** | 0.217** | - |
| | Experience | 0.109* | 0.047** | 0.011 | - |
| PEF8 Your input is no longer needed because it can be replaced by technology in the near future? | Perceptions | - | - | - | - |
| | Job insecurity | 0.091 | 0.027** | 0.198** | - |
| | Experience | 0.104* | 0.055*** | 0.010 | - |
| PEF9 You don't learn to use new technology well enough? | Perceptions | - | - | - | - |
| | Job insecurity | 0.030 | 0.014* | 0.025 | - |
| | Experience | 0.035 | 0.028** | 0.001 | - |
| PEF11 Have you changed jobs in the last 5 years? | Perceptions | - | - | - | - |
| | Job insecurity | -0.021 | -0.001 | -0.080 | - |
| | Experience | -0.024 | -0.001 | -0.004 | - |
| PEF12 Have you been unemployed or laid off in the last 5 years? | Perceptions | - | - | - | - |
| | Job insecurity | -0.005 | -0.013* | -0.008 | - |
| | Experience | -0.006 | -0.027** | -0.001 | - |
| PEF13 Is the atmosphere in our workplace encouraging? | Perceptions | - | - | - | - |
| | Job insecurity | -0.120 | -0.031** | -0.175* | - |
| | Experience | -0.138* | -0.063*** | -0.009 | - |
| PEF14 Is there enough discussion about work organisation or problems in our workplace? | Perceptions | - | - | - | - |
| | Job insecurity | -0.134 | -0.028* | -0.135* | - |
| | Experience | -0.155* | -0.057*** | -0.007 | - |
| PEF15 Does our workplace appreciate the work experience of older employees? | Perceptions | - | - | - | - |
| | Job insecurity | -0.108 | -0.031** | -0.121* | - |
| | Experience | -0.125* | -0.063*** | -0.006 | - |
| PEF16 How much competition is there in your work unit? | Perceptions | - | - | - | - |
| | Job insecurity | 0.062 | 0.021* | 0.148* | - |
| | Experience | 0.071 | 0.043** | 0.007 | - |

Notes: The significance levels (based on the *z* tests) shown here are for the unstandardised solution, because the specific *z* tests for the indirect and direct effects are not provided in the standardised solution (Acock, 2013, p. 76).
***p < .001, ** p < .01, * p < .05.

Table III. Comparison between organisations using vs. non-using technologies at work in terms of major indicators of contradiction, experience, and perception.

| | Technologies at used at work | Technologies at not used at work |
|---|---|---|
| high-general-skill occupations | Experiences of previous dismissals in the organisation have the highest significance. Digitalisation affects the speed of work to a ***greater extent***. Conflicts between managers and workers or between workers are ***not significant***. Two groups of indicators describing threat (the threat of layoff, dismissal, unemployment, unexpected changes, increase in workload, relocation of workplace, or the threat that the job will be eliminated due to replacement by technologies) and social support (work atmosphere is supportive, work arrangement is the topic of discussions, experience of older colleagues is appreciated) are more pronounced ***to a major extent*** and ***are seen as indirect effects for*** '***experience from technologies***'. | Digitalisation affects the workload and the efficiency of work to a greater extent. The threat that a worker will not learn enough about new technologies is ***important***. The threat of disability, unexpected changes, or an increase in workload is ***significant to a minor extent***. |
| low-general-skill occupations | Major organisational changes, the threat that the job will be eliminated by technologies or artificial intelligence, the changes in the employees' number during the three previous years, and discrimination due to the managers' activity have the ***greatest significance***. Previous layoffs in the organisation have the ***greatest significance***. Opportunities for further development, opportunities for participation in the organisation's activity, opportunities for changing workplace, and opportunities for finding a new workplace are ***not significant***. Two groups of indicators describing threats (of layoff, dismissal, unemployment, disability, unexpected changes, increase in workload, relocation of workplace, or the threat that the job will be eliminated due to replacement by technologies) and social support (work atmosphere is supportive, work arrangements are the topic of discussions, experience of older colleagues is appreciated, competition between workers) are more pronounced to a major extent and ***are seen as indirect effects for*** '***job insecurity in the workplace***'. | Covariance between and job insecurity and perceptions of technologies is the ***highest***. The threat that a worker will not learn enough about new technologies is ***important to a greater extent***. The fact that the work atmosphere is supportive, the work arrangement is the topic of discussions, and the experience of older colleagues is appreciated are important to a ***greater extent***. The threat of layoff, dismissal, and unemployment is significant to a minor extent. Relocation of the workplace or the threat that the job will be eliminated due to replacement by technologies is ***significant to a minor extent***. |

Supplementary material. Description of the items used in the analysis.

| Factor | Code | Item | Scale |
|---|---|---|---|
| Factor 1 ‘Job insecurity in the workplace’ | CWP1 | Other major organisational changes? | 1=Happened<br>2=Coming<br>3=Happened and are coming<br>4=Not happened |
| | CWP2 | Changing the ways of doing work with technologies or using artificial intelligence, etc.? | 1=Happened<br>2=Coming<br>3=Happened and are coming<br>4=Not happened |
| | CWP3 | Have workers been made redundant in the last three years? | 1=Yes<br>2=No |
| | CWP4 | Have workers been made laid off in the last three years? | 1=Yes<br>2=No |
| | CWP5 | Have workers been made dismissed in the last three years without being replaced? | 1=Yes<br>2=No |
| | CWP6 | Has the number of employees at your location changed in the last three years? | 1=Clearly increased<br>2=Increased to some extent<br>3=Remained unchanged<br>4=Reduced to some extent<br>5=Clearly reduced |
| | CWP7 | How many conflicts do you have between your supervisor and your subordinates in your work unit? | 1=A lot<br>2=Quite a lot<br>3=To some extent<br>4=Not at all<br>5=The question is not relevant |
| | CWP8 | How many conflicts do employees have in your work unit? | 1=A lot<br>2=Quite a lot<br>3=To some extent<br>4=Not at all<br>5=The question is not relevant |
| | CWP9 | Discrimination by supervisors. | 0 =No<br>1 =Yes |
| Fi | EETI1 | How has digitalisation affected the fast pace of work? | 1=Added to it |

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| ‘employees’ experience of ’ | | | 2=Reduced it<br>3=Has not affected it |
| | EETI2 | How has digitalisation affected the workload? | 1=Added to it<br>2=Reduced it<br>3= Has not affected it |
| | EETI3 | How has digitalisation affected work efficiency? | 1=Added to it<br>2=Reduced it<br>3= Has not affected it |
| | EETI4 | What opportunities do you have in your current job to develop yourself? | 1=Good<br>2=Some<br>3=Poor |
| | EETI5 | In your current workplace, do you have good, some, or poor opportunities to participate in the development of your own work organisation? | 1=Good<br>2=Some<br>3=Poor |
| | EETI6 | If you could change to another job for the same salary, would you change? | 1=To the same profession<br>2=To a different profession<br>3=No change at all |
| | EETI7 | What opportunities do you think you would have to get a new job? | 1=Good<br>2=Some<br>3=Poor |
| Factor 3 ‘Employees’ perceptions of future of work and employment’ | PEF1 | The threat of layoffs? | 1=Yes<br>2=No |
| | PEF2 | Threat of dismissal? | 1=Yes<br>2=No |
| | PEF3 | The threat of unemployment? | 1=Yes<br>2=No |
| | PEF4 | The threat of incapacity for work? | 1=Yes<br>2=No |
| | PEF5 | Unforeseen changes? | 1=Yes<br>2=No |
| | PEF6 | Increasing workload over tolerance? | 1=Yes<br>2=No |
| | PEF7 | Moving job to another location? | 1=Yes<br>2=No |

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| | PEF8 | Your input is no longer needed because it can be replaced by technology in the near future? | 1=Yes<br>2=No |
| | PEF9 | You don't learn to use new technology well enough? | 1=Yes<br>2=No |
| | PEF10 | The uncertainty of my work situation makes it difficult to make plans for the future. | 1=Absolutely true<br>2=Pretty much true<br>3=Not really true<br>4=Not true at all |
| | PEF11 | Have you changed jobs in the last 5 years? | 1=Yes<br>2=No |
| | PEF12 | Have you been unemployed or laid off in the last 5 years? | 1=Once<br>2= Multiple times<br>3= Not at all |
| | PEF13 | The atmosphere in our workplace is encouraging. | 1=Completely agree<br>2=Agree to some extent<br>3=Neither agree nor disagree<br>4=Somewhat disagree<br>5=Completely disagree |
| | PEF14 | There is enough discussion about work organisation and problems in our workplace. | 1=Completely agree<br>2=Agree to some extent<br>3=Neither agree nor disagree<br>4=Somewhat disagree<br>5=Completely disagree |
| | PEF15 | Our workplace values the work experience of older employees. | 1=Completely agree<br>2=Agree to some extent<br>3=Neither agree nor disagree<br>4=Somewhat disagree<br>5=Completely disagree |
| | PEF16 | How much competition is there in your work unit? | 1=A lot<br>2=Quite a lot<br>3=To some extent<br>4=Not at all<br>5=The question is not relevant |