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The equity of opportunities in emerging service work robotisation

Tuuli Turja
Faculty of Social Sciences, Tampere University, Tampere, Finland

Abstract

Purpose – In a best-case scenario, both organisations and their employees gain from technological changes by staying up to date on developing digitalisation. However, opportunities to learn and use modern technologies may not be shared equally in the workplace. Employee groups can be divided between those with and without access to new technologies. This study aims to examine the extent to which the position of an employee may be associated with the opportunity to work with robots.

Design/methodology/approach – Health-care work was chosen as an exemplary context of emerging robotisation. To gain correlative evidence on how the position and technology orientation of an employee associate with access to care robots, the study used online survey data collected from Finnish care workers ($N = 226$).

Findings – Workplace hierarchies were found to play a significant part in robotisation. Management experience increased the probability for an employee to have access to care robots, but this position did not differentiate between the employees in their aspiration to use care robots. Individual interest in technology was associated with robot use only among care workers with no management experience, whereas managers' access to robots did not depend on their personal interests.

Originality/value – This study brings new information about the equity of robot-use opportunities in workplaces. Distinctive to care robots was the significant number of motivated non-users. Thus, adding to the categories of "have-bots", "have-nots" and "want-nots", this study introduces an important group of "want-bots".

Keywords Change management, Informal learning, Opportunities, Participation, Robot, Technological change

Paper type Research paper

1. Introduction

In the digital age, working life is changed by progressively intelligent, autonomous systems and machines that are assisting people in both data-centred and manual tasks. Robots, as combinations of digital systems and mechatronic mobile machines, are now emerging into new fields of work. Robots are stepping out of the industrial realm and into service work, where sometimes it is more relevant to talk about *working with* robots than about merely *using* robots.

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The difference between working with robots and using robots as separate equipment is most evident in human-centred service work where successful interaction is a priority and robots cannot replace humans as interactional partners of customers or patients. For example, in the case of care robots, the interaction would be based on a *triadic* relationship of the care giver, the care receiver and the robot (Parviainen *et al.*, 2018). The human–robot interaction is also challenged by how technological changes are being typically planned by other groups of people than the ones implemented the robots into the everyday work. In an emerging phase of robotisation, people making the investment plans may have different views of robots than those who end up working with this new technology.

The only constant in digitalisation seems to be the constant change. For many professionals, this means working in an environment that is ever developing and changing. As Ivaldi *et al.* (2021) state, the continuous technological changes at workplaces impact not only the reforming organizations, but also the social systems and skill expectations of workers. Technological changes represent themselves, not as something that needs one-time tackling, but rather as something that demands continuous development and learning. Also, it is not only about the demands, because continuous learning and workplace development can be understood as heightened learning opportunities for employees. In a best-case scenario, both organisations and their employees find themselves benefitting from the continuous development of work.

In reality, a win–win situation is not always the case. Workers do not seem to have obtained a higher level of autonomy or participatory decision-making power over the decades of technologisation (Ivaldi *et al.*, 2021). Therefore, it is questionable whether workers can benefit from a stream of technological changes they do not have a say in. An enabling learning environment is not always given (Ellström *et al.*, 2008). The resources given to learn and get acquainted with the new systems and working methods are often perceived as underestimated (Vänni *et al.*, 2019). Without the time and other resources dedicated to learning them, it is difficult to adopt and accept the changes to the workplace. The lack of resources makes it particularly unlikely for the employees to self-direct into learning and innovating with the new technologies.

In their review, Ivaldi *et al.* (2021) identified organisational learning as one of the keys to reassuring that the changes in the workplace have expected, positive outcomes. When it comes to technology, learning amounts to more than just providing theoretical information, and people need to be introduced to the new systems and equipment hands-on. As Billett (2001) has summarised, workplace learning is made through active participation. Yet, there lies a question of who or which groups of people are introduced to the new technology. Because despite the ever-constant changes in the society and workplaces of the digital age, opportunities to keep up with modern technologies may not always be shared equally.

In his meritorious research on the digital divide, Jan A.G.M. van Dijk (2005, 2006a, 2006b) has concluded that inequality among people and their given positions lead to unequal division of resources and different opportunities to use digital technologies. A particular job or position determines the actual opportunities for a worker to get material access to the technology or to develop the motivation to use technology (van Dijk, 2005, p. 138). According to van Dijk (2006a, p. 186), workers who have access to advanced and novel technology are the ones with greater opportunities to further develop their work and maintain their status in the workplace hierarchy. This either explicit or implicit hierarchy can be seen as feeding itself and being a part in causing a permanent polarisation between employees who have both technical skills and higher positions and employees of a lower rank and whose needs and advances in technical skills are not taken into consideration.

Whereas van Dijk (2005) has focused on the internet and computerisation, the current study tests the theory in the context of service robots used at work. Robotisation is a type of digitalisation where the focus is on the new equipment instead of invisible operating systems or software. In this study, care robots used by nurses are chosen as a specific case of robotising a novel field of work. The study examines the extent to which one's position (management experience) and technology orientation (general interest in technology) relate to the opportunity of working with care robots. The main question of this study is: does employee position in the workplace, rather than individual motivation, dictate the opportunity to work with robots?

2. Workplace learning in health-care digitalisation

Organisational and technological innovations require workplace learning for their mere definition of renewed ways to practice work. Technologised work and infrastructures demand new skills that can be achieved by formal and informal learning. Formal workplace learning is contextually structured (time and place) where employees have the opportunity to be coursed and educated about the new systems, tools or technologies. Informal learning derives from workplace activities and interactions (Claret *et al.*, 2020). It is less structured and more dependent on the initiatives of the learners themselves (Kittel *et al.*, 2021). Informal learning occurs, for example, when a robot is introduced into a workplace and is drawing spontaneous attention from an employee, who is interested to observe and willing to learn about its use and potential (Marsick and Watkins, 2003).

Informal, continuous learning is emphasised especially in robotisation as a device-centred form of digitalisation. In addition to formal education, learning about robotic devices requires hands-on demonstrations, practice and human–robot interaction (Zuzelo *et al.*, 2008). From this socio-technical interaction with robot(s), people learn and develop new skills (Søraa and Fostervold, 2021). In the objectives of maintaining a lifelong learning culture at the workplace, informal learning situations are considered to be building continuous learning more than the formal, time-restricted learning settings (Kittel *et al.*, 2021). It is one thing to take a course about basic functions of a robot and another thing to learn about the robot by interacting with it while simultaneously finding new ways to apply it in everyday work. That said, formal and informal learning are found to complement each other, and especially formal learning situations are plausible precursors for informal learning (Richter *et al.*, 2020).

Not only formal education takes resources. When new technology is being introduced in the workplace, person-hours has to be allocated for people to learn to use the technology. The reality in health care is that people are bound to schedules and often simultaneously to insufficient resources. As Zuzelo *et al.* (2008) concluded after interviewing nurses in the USA, when people have a job to do in a limited time frame, there is no extra time provided to deal with new technology (Vänni *et al.*, 2019). There are also signals that workplace learning is not adequately facilitated in a care work context when it comes to organising and leading informal learning in a participatory form of, for example, workshops and introductions of new technology (Ellström *et al.*, 2008; Lizier and Reich, 2021).

Workplace learning as an organisational culture is considered a top-down measure of how employers support and reward their employees of learning (Kittel *et al.*, 2021; Marsick and Watkins, 2003). However, individual learning opportunities can also vary within an organisation, based on the personnel group one associates with. The strategy to ensure the voluntary participation and education to every staff member equally would be promoting the equity of opportunities all the way to the ideology of workplace democracy (Claret *et al.*, 2020; Timming and Summers, 2020).

Moreover, organisational and technological changes rely on knowledge and particularly knowledge management where collective information is acquired from all available sources, employees and stakeholders (Barão *et al.*, 2017). When it comes to practicing everyday work, the employees are considered as an important source of knowledge (Brown and Cregan, 2008). Hence, from a perspective of collective knowledge, it can be viewed as an inadequate strategy to gather information and input only from certain groups of employees. Firstly, in the planning phase of a technological change, staff members offer important insights about the practices, working methods and the workflow, which can be affected by the new technology. Then, in the implementation phase, learning about new technologies such as robots require direct participation from everyone involved (Boxall and Purcell, 2016), including access to both the technology and the information about the technology.

3. Care robots and the theory of digital divide

Introducing the concepts of material and motivational access to technology, the theory of the digital divide refers to the different opportunities certain people or groups of people have when it comes to using new technologies (van Dijk, 2005, 2006a). It is acknowledged in the theory that the acquired job position determines the actual opportunities for a worker to have material access to certain new technology or to even develop the motivation for using that technology (van Dijk, 2005, p. 138). By this, van Dijk (2005) treats motivational access as rising from the opportunity to use certain forms of technology. However, intrinsic motivation to use technology can originate from a general interest in technology and its advances. In a similar vein, the lack of technological orientation may lead to excluding oneself from technological advances even before knowing about possible access to it at the workplace. All in all, referring to motivational and material access, people excluded from using new technology in their work can be categorised coarsely as "want-nots" and "have-nots" (van Dijk, 2006a, p. 180).

In the industrial sector, robot use is well established and quite straightforward. The employees who are expected to use robots have access to them, and the use is mandatory because the employers expect efficient utilisation of their investment. However, in service work, material access may be more elusive and based on a specific group of people viewed as suitable to work with robots. In other words, only a part of the staff is chosen to have access to this new technology ("have-bots" vs "have-nots"). In addition to the selection made by the employer, it is also possible for individual motivation to regulate the selection of who gets to use the robot(s). The employees interested in technology can make their orientation known and volunteer to work with new and robotic systems ("want-bots"). People who have a general interest in technology also have on average a higher intention to use robots (Turja *et al.*, 2019). Motivational access ("want-nots") is typically reduced when people do not want to use or are anxious about the use of robots (Naneva *et al.*, 2020). In the assumption that the individual technology orientation has a positive association with both the opportunities and the motivation to work with robots, the hypotheses are as follows:

H1. Interest in technology associates positively with (a) working with care robots, (b) the aspiration to work with care robots.

Only after motivational and material access to robots ("have-bots") does it come down to digital literacies (i.e. the ability to find, evaluate and produce information on digital platforms) and other skills on how to learn and to use the technology (van Dijk, 2006a, pp. 181, 207). As care robots are new types of technology, everyday work considered, the use of care robots is still in the stage where both motivational and material access appear most relevant. Most health-care workers do not have first-hand experience in the use of robots.

Therefore, care robotisation is still more about expectations and opportunity-sharing than about skill requirements (Turja *et al.*, 2019). Employees with no access to robots ("have-nots") are still a norm in the current health-care environment. Robots are being gradually introduced to health care, and most first-hand experiences of care robots are based on single pilots and workshops (Turja *et al.*, 2020). There are also implications that robots are piloted most commonly among those groups of employees who enjoy a higher position in the workplace hierarchy (Turja *et al.*, 2018). Unequal participation reinforces existing positional inequalities (van Dijk, 2005, p. 178), and if those of a higher place in the hierarchy are chosen to work with robots, this can anchor their position as those who get more opportunities, both currently and in the future. Assuming that those with management experience have a higher probability to have material and motivational access to new technologies in the health-care sector, even beyond personal interests in technology, it is hypothesised that:

H2. Management experience moderates the association between interest in technology and (a) care robot use, (b) the aspiration to work with care robots.

Care work and care facilities are known for their strong hierarchies (Sellman, 2010). Thus, the assumptions in *H2* are made although the Finnish context could also point in an opposite direction. Finland is a democracy with low power distances in society as well as trust and consensus between the population and decision-makers (Hoftstede, 2016; Saarinen *et al.*, 2019). These attributes could also result in hierarchical positions in the workplace not impacting opportunities in care robot implementation. Finland is also a country that has long invested in media education and digital skills from elementary to vocational schools, and where health technology has an established role in nursing education (Erstad *et al.*, 2021). Moreover, in Finland, national digital health strategies have a clear focus also on healthcare workers' needs (Socha-Dietrich, 2021).

Finland makes an especially interesting case for this study because it represents a country where not only do health-care workers have a good deal of technology education, but also empirical studies have shown that they have a high trust in their ability to use new technology in their work (Turja *et al.*, 2019). However, the question remains whether learning and choosing new technology still remains inclusive in workplaces despite the issue of skills and capabilities (van Dijk, 2006a, p. 178).

4. Method

Finnish health-care workers' ($N = 226$) experiences and views about robots were collected in an online survey during the timeframe of November–December 2020. The invitation to the study was sent to members of the Finnish Union of Practical Nurses and the Union of Health and Social Care Professionals in Finland, who worked in elder care services and had expressed their willingness to take part in a follow-up study after a larger, random sample data collection in 2016. The response rate was 56%. According to the selection bias analysis, there were no significant differences in the distributions of age, gender and management experience.

The respondents were predominantly female (94%), aged from 24 to 67 (M = 46.06, SD = 11.3, Md = 44). The sample consisted mostly of practical nurses (54.2%) and registered nurses (26.5%), with an addition of miscellaneous professionals (19.4%), such as social advisors or medical assistants working in a care home. The mean of the reported work experience in the field was 13.4 years (Md = 15). Nearly every fourth of the respondents (23.9) reported having management experience. In its original language, the question of *"Have you worked as a manager or as a foreman?" (Yes/No)* connotes managing people and

having subordinates. The dichotomy in the management experience was used to indicate the position in the workplace.

Technology orientation was measured with the question: "Are you *very interested*, *moderately interested*, or *not at all interested* in technology and its developments?". The item was applied from a validated and widely used Eurobarometer questionnaire (Special Eurobarometer 382, 2012). The interest in technology was quite high among the respondents. More than half (52.7%) of the health-care workers reported being very interested in technology and its developments, 46% moderately interested and 1.3% not interested.

The dependent variable of robot use status was measured by self-developed categories. The sub-categories and their main categories of robot users ("have-bots") and non-users ("have-nots", "want-nots", "want-bots") are described in Figure 1. "Have-bots" (n = 12) represent the health-care workers who used care robots as part of their job. The sample found that eight care workers reported choosing to use robots proactively in their job and four care workers using robots following management's expectations. Most commonly, the respondents reported working with a medicine dispensing robot used in home care or a plush robot seal, called Paro, used in dementia care.

Among the non-users, or rather the "have-nots" and "want-nots", the largest category included the care workers who expressed lacking material access because their workplace did not use robots (n = 135). The category was overlapped by respondents who reported not using robots in their workplace for lacking either material or motivational access (n = 11). Another and a particularly significant sub-category of non-users emerged from the data. They were named "want-bots" to describe how certain non-users reported aspiration to use robots (n = 58). Thus, the "want-bots" represent the respondents who did not have material access to care robots at the time of the study but expressed motivation to work with robots as part of their job.

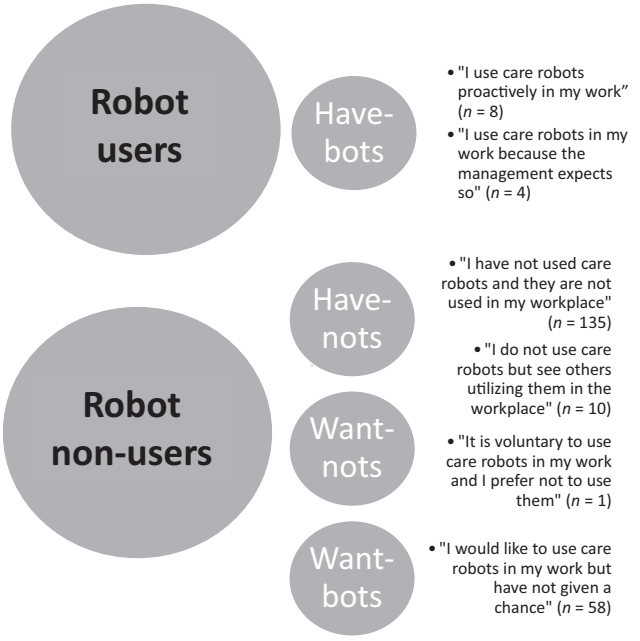

Figure 1.
Robot use status among the respondents (N = 216)

Analysing how one's position and technology orientation are associated with the opportunity to work with care robots, three-way associations between the robot use status, interest in technology and management experience were tested by the χ^2.

The study complies with the regulations of the Finnish Advisory Board of Research Integrity and, more broadly, with the Declaration of Helsinki. All the participants were informed about the aims of the study, and they had the right to decline participation. Consent was requested at the beginning of the survey, and the data handling was designed to ensure participants' anonymity.

5. Results

The data confirmed how robot use is still a curiosity in health care, and most of the respondents fell into the category of "have-nots" (Figure 1). The data showed, however, that a significant proportion of the respondents who do not have the opportunity to work with robots would be motivated to do so. These particular types of "have-nots" were named "want-bots" as a category distinct from the "have-bots", who already work with robots, and the "want-nots", who choose not to work with robots.

The highest proportion of the respondents already working with robots expressed being very interested (66.7%) in technology. The non-users were more divided in this regard. The "want-bots" had an extremely high number of those very interested in technology (75.9%), but among other non-users, only 44.1% reported being very interested in technology. The differences between user status groups were statistically significant ($\chi^2(2) = 17.63$, $p < 0.001$).

Unlike the interest in technology, the management experience did not have enough predictive power to directly explain the variation in robot user status. The user status did not vary either by the yearly amount of work experience (−15 years vs longer), age (aged −44 years v older) or gender.

In the correlation analysis, those with management experience reported on average higher interest in technology ($r_s = 0.241$, $p < 0.001$). Neither the management experience nor the interest in technology correlated with age, gender or the amount of work experience.

5.1 Hypothesis testing

The moderating effect of management experience in robot use was the main finding of the study, which supported the assumption where workplace hierarchies play a part in care robotisation.

H1a was supported by the first finding, where respondents who reported not using care robots at work had on average lower interest in technology in general ($\chi^2(1) = 10.81$, $p < 0.001$). *H1a* had to be set aside; however, as the *post hoc* analysis showed support for the contesting *H2a* and the moderating effect of management experience. Only the respondents with no management experience had a significant association between interest in technology and using care robots ($\chi^2(1) = 7.15$, $p < 0.01$).

Similarly, *H1b* was in line with the finding, where the interest in technology was associated with the aspiration to work with care robots ($\chi^2(1) = 13.79$, $p < 0.001$). Rejecting *H2b*, the association between robot use status and individual technology orientation did not depend on whether the health-care worker has a higher position or not.

6. Discussion

This study brings new information about the equity of technology-use opportunities in the era of emerging service work robotisation. The results support the theories of certain groups of people having more access to using new technology in their work. A higher position

among health-care workers was linked to enhanced opportunities to participate in care robot trials and workshops. In addition to supporting the theory of the digital divide (van Dijk, 2005, 2006a, 2006b), the finding leads to the conclusion that this inequality in care work robotisation has held time over the years (Turja *et al.*, 2018).

Uneven participatory opportunities are reflected in inequalities in workplace learning (Claret *et al.*, 2020). For an individual employee, the opportunity to participate – whether in a pilot project introducing a robot or in the more frequent robot use in everyday work – is to be included in the organisation's goals to learn and work with new and current technologies. Furthermore, an initial invitation to a formal learning situation can enhance the future motivation for informal, everyday learning. Adapting the findings of Richter *et al.* (2020), a successful participation in the formal robot introduction course or workshop predicts engagement to the more informal and self-directed learning to come.

In the initial research question, this study was positioned at micro and meso levels, hypothesising that both the individual technology orientation and more structural management experience would be associated with access to working with robots. The findings, however, highlight the meso level and how resources and opportunities are divided in the workplaces by hierarchy. The results imply that preconditions to using robots can be closer to a socially shaped learning environment of the workplace than a learner-centred approach where the skills and motivation of an individual employee result in participation. Because the position of the employee is associated with the opportunity to work with care robots, the conclusion is that hierarchies among the health-care workers are still existent. The found inequality can be a way to find understanding about the real points of workplace learning, as is concluded by Claret *et al.* (2020). Without possibilities to participate formally, there may not be much to build informal learning onto.

Even in Finland, an example of a country of low power distances, workplace hierarchies were found to play a significant part in emerging robotisation. The results imply that resources to test and learn the newest technology are manoeuvred to the management level. Giving opportunities to the chosen employees in higher positions serves only an outcome where hierarchies are further supported. In addition, if the opportunities to participate in robotisation and other technological changes are given to only certain level workers, organisations leave out a great deal of practical knowledge that could be used in implementing the changes and technologies in everyday work. It is further noticeable that the significant factor was indeed the management experience, and, for example, the amount of work experience did not explain the better opportunities to use and learn about robots.

Those who worked with robots reported a relatively high level of interest in technology. This result was, however, overshadowed by the considerable amount of interest in technology that was expressed by the motivated would-be users named "want-bots". As prior studies show, experience in technology may increase the intention to use technology (Turja *et al.*, 2019), but as this study implies, employers should give more room for employees' personal orientation instead of their position in the workplace. A win–win situation would be achieved if the individuals with the greatest motivation were included in the technological changes. Interest in technology is to be viewed even as an appreciated attribute when it comes to working with robots and innovating new ways to develop their applications in the workplace. However, the evidence here suggests that robots are particularly available, not necessarily to those who have personal interest, but to those with a higher position in the workplace.

At the same time, individual orientation towards technology seems to somewhat benefit basic-level employees. Health-care workers with no management experience have more opportunities to work with robots if they have an interest in technology, whereas managers'

robot use is not dependent on their personal interests. This finding was further supported by the fact that when it came to aspirations to work with care robots, there were no differences between those with or without management experience. In non-robotised workplaces, interest in technology and aspirations to use care robots were distributed evenly among different level employees. Despite this, in workplaces where robots were already in use, it was mainly those who had management experience who had been taken aboard. This kind of working life polarisation highlighted in digitalisation is described in van Dijk (2006a, pp. 184–186), where one of the prospects includes a future of an even greater division between different level employees. The division and polarisation are viewed as contributing to the development, where opportunities are given to those employees who already have more position-based opportunities, while the rest are excluded from learning about new technologies, including robots. For those excluded, this development makes the efforts to progress in one's career and, say, getting promoted, more difficult, if not impossible (Bejaković and Mrnjavac, 2020; van Dijk, 2006a). Digital skills can produce a vicious circle of inequality when managers are able to further develop and update their digital competence and ensure their position both in the organisation and in the labour market (van Dijk, 2006a, p. 185).

This may not be the direction in which we want to design working life and its hierarchies. Instead, we might choose to increase workplace democracy and motivation-based equality. Workplace democracy is, after all, a prominent way to increase trust and organisational success (Timming and Summers, 2020). Sustaining needless hierarchies, the future may be more polarised than ever between those who have learning opportunities and those who are left in a holding pattern, as well as between those who are supported in keeping up with technological advances and those who are at risk of having a disadvantaged position in labour markets because of their poorer knowledge of new technologies. In the digital age we live in, digital skills predict labour market positions and better employment, which are particularly associated with the history of continuous learning, digital competence and digital literacy (Bejaković and Mrnjavac, 2020).

The digital divide is strongly linked to digital literacy (van Dijk, 2005, p. 1) and the extent to which only digitally literate people are able to advance their own work and their workplaces in light of technological changes (Pauliková *et al.*, 2021). In addition to general digital literacy, robots need a specific kind of literacy. Robot literacy is the ability to understand, critically evaluate and use a robot. It is also essential to everyone working with robots. Robot literacy includes technical and social dimensions, where it is not only about technical skills and how the robot is operated but also about understanding what the robot can and cannot do, how the algorithms behave, how the robot stores data and what it means to be a human–robot dyad or a human–robot-human triad (cf. Parviainen *et al.*, 2018). As robots step into new lines of work, these skills become continuously more important in our society. Continuous workplace learning is most essential, especially as current working life – with a variety of emerging intelligent technologies – may be very different from the working life people with long work histories have originally applied and qualified for.

6.1 Limitations

Van Dijk's theory has received criticism in its premise that digitalisation is something people *should* be motivated for (van Dijk, 2006b). This current study repeats the criticised viewpoint by describing access to care robots as something to be pursued. The reality, however, is that these data do not reveal the robot use motivation of the "have-bots". In other words, the claim that employees of higher ranks are privileged in their access to robots

regardless of their technology orientation is deterministic, and more research is needed to learn about the conditions and level of choices given.

A similar issue lies with the "have-nots". As van Dijk (2006a, p. 180) states, the division between the "want-nots" and the "have-nots" is neither sharp nor constant. This ambiguity shows in this study as well and is partly due to the overlapping categories in the data. Future studies should dig deeper into the dynamics between the motivated and non-motivated among non-users. In a qualitative study design, such as an in-depth interview, it would be recommended to search for patterns for how to include the motivated employees in the development and planning work of technological changes.

As a final note, the item requiring if the respondent have worked as a manager or as a foreman is problematic, for one, because of the perfect tense of the phrasing. A variable offering information about when and for how long has the management experience taken place would have been more informative.

6.2 Implications

To support all personnel in the changing world of digitalisation, organisations and their change management should plan technological changes in a more democratic way, enabling learning for a diverse range of employees. Ellström *et al.* (2008) suggest programmes for leadership development on how to organise and lead informal workplace learning. Ivaldi *et al.* (2021) emphasise reskilling as one of the keys to keeping up with technological changes. They even initiate that in the future, employment contracts may include continuing training as one of workers' written rights. Along with formal workplace learning, another key to investing in technologically competent personnel in robotisation is to promote informal learning and interest in new technologies among a wide variety of workers. Formal workplace learning and informal cumulative experiences are practices worth of supporting by the management. Digitalisation certainly calls for participatory management, where employees have an opportunity to be involved in and learning about the emerging change.

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About the author

Tuuli Turja (PhD) studies social and motivation psychology in technological changes at the Work Research Centre of Tampere University. In her work, Turja is used to combining statistical methods to humanistic frameworks and research questions. Tuuli Turja can be contacted at: tuuli.turja@tuni.fi