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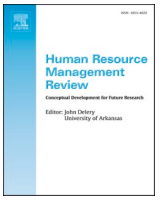

A conceptual review of the love-hate relationship between technology and successful aging at work: Identifying fits and misfits through job design

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ABSTRACT

Previous research suggests that technology can both enhance and undermine successful aging. However, few studies have combined insights on aging and technology in the work context. This paper aims to contribute to the literature on successful aging at work and STAARA technology by integrating these two literature streams through a job design perspective in a conceptual review. Based on insights from the literature on successful aging at work and technology we propose that STAARA technology can facilitate successful aging at work by reducing physical and emotional demands and increasing skill variety, autonomy, and support. Whereas STAARA technology can also harm successful aging at work by reducing autonomy, skill variety, and social support. Self-regulatory behaviors, an open workgroup climate, and HRM practices can help to minimize the potential misfit between technology and aging at work, whereas age discrimination is an important constraint. The propositions of this paper should be tested in future research.

1. Introduction

Due to demographic changes such as declining birth rates and increasing life expectancies (United Nations, 2019) and political trends such as the raising of the retirement age in many western countries (Taylor & Earl, 2016), employees have to work until a later age. Therefore, organizations are challenged to facilitate the extension of employees' working lives. Kooij, Zacher, Wang, and Heckhausen (2020) argue that employees will be able to extend their working lives when they age successfully at work, which reflects the 'proactive maintenance, or adaptive recovery (from decline) to, high levels of ability and motivation to work' (p. 14). Truxillo, Cadiz, Rineer, Zaniboni, and Fraccaroli (2012) suggest that job design plays an important role in the facilitation of successful aging at work. In line with the Job Demands-Resources (JD-R) framework (Bakker & Demerouti, 2007; Demerouti, Bakker, Nachreiner, & Schaufeli, 2001) previous research found that job resources and challenging demands can facilitate successful aging at work, whereas hindering job demands can hamper successful aging at work (Brady et al., 2020; Pak, Kooij, De Lange, & Van Veldhoven, 2019; Van den Berg, Elders, de Zwart, & Burdorf, 2009). Moreover, previous studies have shown that certain job demands and resources become more important with age (Truxillo et al., 2012; Zacher & Schmitt, 2016).

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At the same time, the current literature on work and technology suggests that job design is influenced by a range of new technologies, for example, through automation or algorithms used for decision-making (Parker & Grote, 2020). Although these technologies can have many different shapes and forms, they are generally combined in the acronym STAARA referring to Smart Technology, Artificial Intelligence, Automation, Robotics, and Algorithms (Brougham & Haar, 2017). Whereas earlier studies claimed that due to the application of STAARA technologies a large percentage of jobs was at risk of being automated (Frey & Osborne, 2017), currently more attention is being paid to how technologies can be used to facilitate employees in doing their jobs in a healthy and productive manner (Daugherty & Wilson, 2018; Raisch & Krakowski, 2020). In line with this movement, Parker and Grote (2020) advocate for a more proactive perspective on technology and job design, which focuses on how technology should be adapted to better fit individual needs, values, and competencies.

Based on the insights from the literature on successful aging at work and technology it seems logical that technology can be used to facilitate successful aging at work as technology can shape job design (Parker & Grote, 2020), and job design, in turn, can influence outcomes related to successful aging at work (Pak et al., 2019; Truxillo et al., 2012). In addition, extending the working lives of older employees is seen as a benefit of the current industrial revolution based on STAARA technologies (Caruso, 2018). Yet, to date, the literature streams on aging in the workplace, technology, and job design are not well integrated. Although some studies investigate the impact of technology on the aging process (see for example Alcover, Guglielmi, Depolo, & Mazzetti, 2021; Lindenberger, Lövdén, Schellenbach, Li, & Krüger, 2008; Schaie & Charness, 2003; Schinner et al., 2017; Thompson & Mayhorn, 2012) or propose technology as a potential solution due to labour shortages arising from the aging of the population (Burke & Ng, 2006) the majority of these studies do not focus on job design nor the workplace.

With this article, we aim to integrate insights from both the aging literature and the literature on technology to identify the ways STAARA technology can afford changes in job design and how these changes in turn are related to successful aging at work. We do this by taking a proactive perspective on technology and job design by providing insights in how STAARA technology can facilitate or hinder successful aging at work by outlining how STAARA technology fits or does not fit older employees' needs, values, and competences. In doing so, we contribute to the literature in three ways.

First, we draw upon the JD-R framework (Bakker & Demerouti, 2007; Demerouti et al., 2001) that is commonly used in the field of successful aging at work (see for example Pak et al., 2019) and technology and work (see for example Parker & Grote, 2020) to combine insights from both fields and link them via job design. The JD-R framework is of added value because of the distinction made between the motivational potential of job characteristics, relevant for understanding the impact on the motivational aspect of successful aging, and the health impairment process that is closely linked to the ability to successfully age at work.

Second, research integrating both aging and technology is scarce and is mainly focused on the vulnerability of older employees concerning technology (see for example Alcover et al., 2021; Tams, Grover, Thatcher, & Ahuja, 2021). Although we agree that STAARA technology can pose threats to older employees, we also believe that STAARA technology can facilitate older employees. Indeed, scholars in the field of technology and work have emphasized that technology itself does not have a positive or negative effect (Kranzberg, 1986) as the influence of technology depends on its implementation and use (see Bailey & Barley, 2020). Therefore, we propose that when a proactive approach to the implementation and use of STAARA technology is taken, as described by Parker and Grote (2020), STAARA technology can also be used to stimulate successful aging at work and that the effect of STAARA technology on successful aging at work depends on the way it affects job design. With this conceptual review, we would like to highlight both the positive and negative consequences that STAARA technology can have on the ability and motivation of older employees to (continue) work(ing). In doing so, we draw upon the person-environment fit theory (Edwards, 1991) to establish whether STAARA technology enhances or undermines the fit between demands and abilities and/or needs and supplies of older employees. We argue that successful aging at work is determined jointly by the person and environment (i.e., job characteristics), and this theory allows us to describe the interaction of both contributing to ability component of successful aging by zooming into the demands-ability fit, and to the motivational component of successful aging by studying the needs-supply fit. Based on these interactions we created a research framework that provides avenues for future research. Our final contribution is the identification of enabling factors at the individual, team, and organizational level that can enhance the positive effects of STAARA technology on the person-environment fit of older employees and reduce the negative effects of misfit due to the use of STAARA technology. As the influences of STAARA technology are shaped by context-specific factors (Bailey & Barley, 2020), it is important to understand how the context can play a role in stimulating a love instead of hate relationship between aging and STAARA technology.

This paper is structured as follows: first, we elaborate on aging and STAARA technology. Subsequently we introduce the JD-R model and describe which job demands and job resources, relevant for successful aging at work, we will focus on. Then we discuss how each particular job demand and job resource is influenced due to aging and how STAARA technology could influence those job characteristics to determine whether this fits with the abilities and/or motives of older employees. Subsequently, we determine for each job demand and job resource whether the changes that employees go through when they age and the consequences this has for job design align with the changes that STAARA technology can bring about in job design features which we refer to as fit or misfit. Based on this we formulate propositions to guide future research. Thereafter, we discuss enablers and constraints for creating a better fit between aging and STAARA technology through job design. Finally, we discuss the implications for practice and end with an agenda for future research.

2. Aging and STAARA technology – a recipe for person-environment-fit or misfit?

2.1. Successful aging at work

In line with Kooij, Nijssen, Bal, and van der Kruijssen (2020) we define successful aging at work as 'as the proactive maintenance of, or adaptive recovery (from decline) to, high levels of ability and motivation to continue working among older workers (p.351)'. Employees are usually considered as older employees when they are between 40 and 50 years and older (see for example Ng & Feldman, 2008; Pak, Kooij, De Lange, van den Heuvel, & Van Veldhoven, 2020; van der Heijden, 2003). According to the lifespan development perspective (Baltes & Baltes, 1990), the aging process consists of a combination of gains and losses in physical and mental abilities. Older employees try to maximize age-related gains and minimize age-related losses to maintain their ability and motivation to continue working by selecting goals, optimizing their goals, and compensating for losses (Kanfer & Ackerman, 2004). Both the ability and motivation usually decrease with age (Carmen Martinez, da Silva Alexandre, De Oliveira, Latorre, & Marina Fischer, 2016; Kooij, de Lange, Jansen, & Dikkers, 2008; Van den Berg et al., 2009). More specifically, older employees face losses with regards to their physical abilities and their fluid intelligence (i.e., the ability to think on an abstract level and solve problems), whereas their experience increases (Schalk et al., 2010). Furthermore, socio-emotional selectivity theory (Carstensen, 1995) suggests that work motives change throughout the working lifespan. As employees grow older, they attach more value to emotional goals and less value to goals related to growth and advancement. In line with this theory Kooij, de Lange, Jansen, Kanfer, and Dikkers (2011) found that for older employees the motivation to develop through training and advancement and their motivation to compete with others decreases, whereas their motivation to help others and contribute to society as well as the desire for job security increases with age. Kooij, Zacher, et al. (2020) suggest that those older employees who manage to maintain their work ability (i.e., the extent to which an employee is physically and mentally able to perform their work (Ilmarinen, Tuomi, & Klockars, 1997) and motivation despite the age-related changes mentioned above or are able to recover to high levels of ability and motivation after a decline are aging successfully at work through the adjustment, maintenance, and restoration of person-environment fit. Therefore, we will examine the way technologies impact the person-environment fit for the average older employees using person-environment fit theory (Edwards, 1991) in which we distinguish between demands-abilities fit and needs-supplies fit. Demands-abilities fit reflects the degree to which the knowledge, skills, and abilities of an individual match with the demands of the job (Edwards, 1991; Kristof-Brown, Zimmerman, & Johnson, 2005), whereas needs-supplies fit reflects the degree to which the needs and motives of the individual match with what the organization supplies (Edwards, 1991; Kristof-Brown et al., 2005). Although the way people age differs considerably between individuals (e.g., Bohlmann, Rudolph, & Zacher, 2018; Morack, Ram, Fauth, & Gerstorf, 2013) there are general trends in aging that we will describe in this paper. Moreover, as the majority of research on aging at work focuses on employees working in traditional employment relationships in Western countries, we will focus on this specific group of employees in this paper.

2.2. STAARA technologies

Although the term technology is widely discussed, a consensus about the definition is lacking (Cascio & Montealegre, 2016). The concept generally refers to information, equipment, techniques, and processes to transform inputs into outputs (Robbins & Barnwell, 2006). The acronym STAARA stands for a set of advanced technologies named as Smart Technology, Artificial Intelligence, Automation, Robotics, and Algorithms (Brougham & Haar, 2017), used in the workplace setting (Parker & Grote, 2020). STAARA technologies have the potential to affect the information that employees can access, where work is done, how collaboration takes place, and thereby ultimately also influence work design (Parker & Grote, 2020).

In this paper, we focus on this STAARA category of advanced technologies and take the so-called *ensemble view* of technology, which does not look at technology merely as a tool with predetermined outcomes but recognizes the importance of the material features and the social context in which technologies are taking shape (Kim, Wang, & Boon, 2021). This enables us to describe how STAARA technologies in combination with aging co-evolve with job design, and in what ways the social and organizational context can shape a better fit between aging and STAARA technology to achieve successful aging at work. In line with earlier research (e.g., Alcover et al., 2021; Brougham & Haar, 2017), we aim to study the role of STAARA technologies, a specific category of advanced technologies, and use specific sub-categories of STAARA as examples in our analysis.

2.3. The fit between STAARA technology and successful aging at work

To understand whether STAARA technology can create fit or misfit between older employees and their job demands and job resources the JD-R model is used which divides job characteristics into job demands and job resources. Job demands are the "physical, psychological, social, or organizational aspects of the job that require sustained physical and/or psychological (cognitive and emotional) effort or skills and are therefore associated with certain physiological and/or psychological costs" (Bakker & Demerouti, 2007, p. 312). The JD-R model (Bakker & Demerouti, 2007; Demerouti et al., 2001) proposes that job demands have a negative effect on employee outcomes such as the ability and motivation to continue working (i.e., indicators of successful aging at work) as they can lead to health impairment. That is to say, having excessive job demands is thought to deplete one's personal resources (e.g., energy) and therefore leads to exhaustion (referred to as the health impairment process). In this conceptual review we will focus specifically on physical, emotional, and mental demands as these are likely to influence successful aging at work (Brady et al., 2020; Pak et al., 2019).

Job resources are the "physical, psychological, social, or organizational aspects of the job that are either/or functional in achieving work goals, reduce job demands and the associated physiological and psychological costs and stimulate personal growth, learning, and

development" (Bakker & Demerouti, 2007, p. 312). Job resources are suggested to have a positive influence on work outcomes such as the ability and motivation to continue working, because job resources are expected to bring about a motivational process. Indeed, Brady et al. (2020) and Pak et al. (2019) found positive effects of job resources on work ability and the motivation to continue working. In line with Parker and Grote (2020) and Truxillo et al. (2012), we will focus on autonomy, job feedback, skill variety and use, task variety, task significance, and social support as these are likely to be influenced by STAARA technology and aging.

In conclusion, according to the JD-R model, job demands can initiate a health impairment process, whereas job resources can initiate a motivational process (Demerouti et al., 2001; Schaufeli & Bakker, 2004). In line with Brady et al. (2020), we argue that outcomes related to successful aging at work (i.e. (work) ability and motivation) can be linked to the health impairment and motivational pathway of the JD-R model, where these outcomes are positively influenced by job resources and negatively by job demands. For those reasons, adopting a JD-R lens aids our understanding of how technology and the aging population influence successful aging at work through their combined effects on work design components.

2.3.1. Physical demands

One of the basic assumptions of the lifespan development perspective is that older employees face several losses. One important loss that older employees face is that physical abilities often decrease with age, thereby making physically demanding tasks, such as lifting, generally more challenging for older employees (Ilmarinen, 2001; Ilmarinen, 2007). Thus, older employees generally have a lower demands-abilities fit if their work requires them to perform physically demanding tasks. However, it is noteworthy that individual differences are large (Ilmarinen, 2001). Older employees with physically demanding jobs are most at risk for experiencing losses in their physical work ability (Ilmarinen et al., 1997), whereas older employees who engage in regular physical exercise, have a good sleep quality, refrain from smoking, and are not obese appear to be less at risk for experiencing declines in their physical work ability (Airila, Hakanen, Punakallio, Lusa, & Luukkonen, 2012; Alavinia, de Boer, Van Duivenbooden, Frings-Dresen, & Burdorf, 2009).

At the same time, the burgeoning of STAARA technologies at work has led to the automation of heavy tasks (i.e., a computer/robot performs the task) and thereby a shift from physically demanding to more 'sedentary work' (Parker & Zhang, 2016), such as operating industrial machines or sitting behind computer screens. As physical abilities decrease with age, we expect that this decrease in physical demands due to STAARA technology can help older employees to restore their demands-abilities fit, although there is no research yet to confirm this. Lower levels of physical demands due to robot technology can enable successful aging at work (specifically the ability to continue working) by compensating for the physical losses associated with the aging process and thereby restoring demands-abilities fit, like nurses who have access to robotic devices to help lift patients without straining their backs.

Proposition 1. The influence of STAARA technology on physical demands leads to an increase in/restoration of demands-abilities fit for older employees when STAARA technology leads to a reduction in physical demands which leads to an increase in the ability component of successful aging at work.

2.3.2. Cognitive demands

Cognitive demands refer to work tasks that are complex to perform such as problem solving and information processing. Older employees face both gains and losses with regards to their ability to perform cognitive tasks. Fluid intelligence (i.e., the ability to think on an abstract level and solve problems) tends to decline with age (Salthouse, 1996), whereas crystalized intelligence (i.e., knowledge from previous experience and learnings) tends to increase (Schaie, 1994). As the increase in crystalized intelligence can usually counteract the decline in fluid intelligence mental work ability and job performance is usually not affected for older employees (Ilmarinen, 2001; Ng & Feldman, 2008).

STAARA Technology may lead to increases in *cognitively challenging tasks* (Parker & Grote, 2020). Introducing automation technologies can lead to new tasks and routines that require new or updated knowledge, which leads to higher cognitive demands to adapt to, and to increased insecurity (Demerouti, 2020; Lundh & Rydstedt, 2016). For example, when algorithmic technology can independently perform the more routine and structured physical tasks (i.e. automation), the more cognitively demanding work remains (Demerouti, 2020). Nevertheless these more demanding activities can then be supported by augmentation, which means that humans collaborate closely with machines to perform a task (Brynjolfsson & McAfee, 2014; Daugherty & Wilson, 2018; Raisch & Krakowski, 2020).

As older employees can deal with cognitive demands just as well as their younger counterparts (Brough, Johnson, Drummond, Pennisi, & Timms, 2011) this is not necessarily problematic (i.e., there is no change in demands-ability fit). However, it is important to note that also for cognitive declines due to age the differences between persons are large. Rizzuto, Cherry, and LeDoux (2012) found that older employees with a high educational background, good health, and who are engaged in complex and challenging work are more resilient to declines in cognitive functioning. This implies that if work becomes more cognitively demanding due to automation technology, the differences between older employees will increase. We expect that those older employees with an advanced educational background, good health, and who are engaged in complex and challenging work will be able to age successfully in terms of the ability and motivation to continue working, whereas we expect that the remainder of the employees will have a lower demands-abilities fit.

Proposition 2. The influence of STAARA technology on cognitive demands leads to a decrease in demands-abilities fit for older employees with a low educational background, bad health, that are not engaged in complex and challenging work when new technologies require new skills which leads to a reduction in the ability component of successful aging at work.

2.3.3. Emotional demands

Emotional demands refer to interactions at work that are emotionally draining such as the misbehavior of clients or colleagues (Heuven, Bakker, Schaufeli, & Huisman, 2006). Emotion regulation and self-esteem tend to increase with age (Carstensen, 2009; Robins, Trzesniewski, Tracy, Gosling, & Potter, 2002). Therefore, older adults might be more capable of dealing with emotional demands compared to their younger counterparts. However, due to decreases in fluid intelligence, emotional demands might also be perceived as more stressful by older employees and it might take older employees longer to recover from stressful events such as a negative interactions with a colleague or customer (Scheibe & Zacher, 2013).

Studies on technology suggest that some emotionally demanding tasks can potentially be automated using novel technologies. For example, the introduction of AI-based chatbots can remove the emotionally demanding task of dealing with complaining customers. This can be beneficial for employees who are paid by organizations to show fake positive emotions towards customers, such as in call centers (see for example Dormann & Zijlstra, 2003). As emotional demands can be perceived as more stressful by older employees due to declines in fluid intelligence, we expect that older employees could benefit from technologies that decrease the specific emotional demands that are perceived as stressful by older employees as these technologies can compensate for losses resulting from the aging process. This appears to result in increased/restored demands-abilities fit.

Proposition 3. The influence of STAARA technology on emotional demands leads to an increase in/restoration of demands-abilities fit for older employees when emotionally draining tasks are automated which leads to an increase in the ability component of successful aging at work.

2.3.4. Autonomy

Autonomy refers to the amount of control or freedom that employees perceive in how they can perform their work (Hackman & Oldham, 1975). Based on socio-emotional selectivity theory it is possible to argue that autonomy is both helpful and hindering for older employees (Ng & Feldman, 2015). Ng and Feldman (2015) argue, based on socio-emotional selectivity theory, that autonomy would become more important with age because older employees value positive experiences as provided by job resources such as autonomy more. Moreover, Truxillo et al. (2012) argue that older employees will benefit more from autonomy because they are better able to work independently due to their enhanced experience and crystalized intelligence. Finally, as differences between older employees increase as they age (Bal, De Jong, Jansen, & Bakker, 2012; Bohlmann et al., 2018), autonomy allows older employees to craft their job towards their specific strengths and needs (Kooij, Zacher, et al., 2020; Truxillo et al., 2012). In line with these expectations a meta-analysis of Ng and Feldman (2015) revealed that the influence of job autonomy on job performance and job self-efficacy became stronger with age. However, Ng and Feldman (2015) also argue based on socio-emotional selectivity theory that autonomy could become less important with age because autonomy can foster learning and growth and advancement motives tend to decrease with age. Indeed, they found in their meta-analysis that the influence of job autonomy on job satisfaction, work engagement, affective organizational commitment, job stress and mental health decreases with age. It thus appears that job autonomy is helpful in fostering the ability to continue working, but hindering the motivation to continue working.

Studies on STAARA technology and automation suggest that technologies can both strengthen and undermine employee autonomy, specifically in terms of decision-making at work and choosing when and how to work. Whereas some argue that technology facilitates decentralized decision-making (see for example Grote & Baitsch, 1991; Zuboff, 1988) and higher levels of flexibility and autonomy (Brynjolfsson & McAfee, 2017), others highlight that automation and robotization can particularly be detrimental to the degree of autonomy as more routine or simple tasks are left (Bainbridge, 1983), leading to what is called algorithmic control (Kellogg, Valentine, & Christin, 2020). Algorithmic decision-making can thereby reduce employees' sense of autonomy (Möhlmann & Zalmanson, 2017). Hence, the influence of STAARA technologies depends on their deployment: they can both lower levels of autonomy because of technologies control decision-making, or lead to more autonomy when humans control the technology (Berkers, Rispens, & Le Blanc, 2022; Smids, Nyholm, & Berkers, 2020).

When we combine the insights on autonomy and control from the field of aging and the field of STAARA technology we get a complicated picture. Autonomy can both be helpful and hindering for older employees and STAARA technology can both lead to more and less autonomy. However, if we examine this interplay with the lens of the socio-emotional selectivity theory we can infer some conclusions. If STAARA technology leads to more freedom in when to work this fits with the idea that older employees benefit more from positive experiences, and this can thus lead to more productivity and job self-efficacy for older employees as needs-supplies fit increases. If STAARA technology leads to more freedom in how to work this provides more opportunities for growth and advancement. As the desire to grow and advance weakens with age this could worsen needs-supplies fit and lead to lower levels of motivation for older employees. Moreover, if jobs are simplified by STAARA technology this leads to fewer opportunities for growth and advancement which is less detrimental for older employees. Therefore, simplification of tasks due to STAARA technology would lead to a smaller increase in needs-supplies fit for older employees compared to younger employees.

Proposition 4a. The influence of STAARA technology on autonomy leads to an increase in needs-supplies fit and demands-ability fit for older employees when it results in more freedom in where to work which leads to increases in the ability and motivational components of successful aging at work.

Proposition 4b. The influence of STAARA technology on autonomy leads to a decrease in needs-supplies fit for older employees when it results in more freedom in how to work which leads to a reduction in the motivational component of successful aging at work.

Proposition 4c. The influence of STAARA technology on autonomy leads to smaller decrease in needs-supplies fit for older employees compared to younger employees when STAARA technology results in simplification of tasks which leads to a smaller decrease

in the motivational component of successful aging at work for older employees compared to younger employees.

2.3.5. Feedback

Feedback from the job as well as feedback from others is proposed to become less important with age (Truxillo et al., 2012) because younger employees have stronger growth motives (Kooij et al., 2011) and a stronger need to advance their careers (Kanfer & Ackerman, 2004) than their older colleagues. In line with this proposition, Wang, Burlacu, Truxillo, James, and Yao (2015) found that older employees have lower levels of feedback orientation on *utility* (i.e., the inclination to use feedback to improve performance and thereby achieve career goals) than younger employees. However, older employees had higher levels of feedback orientation on *social awareness* (i.e., the inclination to use feedback to get a better picture of one's social relations). For older employees, the delivery of feedback appears to be more important, whereas for younger employees the quality of feedback appears to be more important (Wang et al., 2015).

STAARA technologies can provide in-depth personalized information about how a person is functioning and make AI-based recommendations (Tong, Jia, Luo, & Fang, 2021), thereby better informing employees about the impact of their work on job outcomes (Parker & Grote, 2020). Although algorithms can provide real-time feedback, there is also a risk of algorithmic control – where constant surveillance is used to collect feedback on employee performance (Kellogg et al., 2020). Moreover, feedback quality can also be reduced by robotics and AI, because of the opacity of AI-generated feedback (Lebovitz, Lifshitz-Assaf, & Levina, 2022), which then decreases the opportunity for learning (Beane, 2019). This might mainly hamper younger employees, who still need to develop their expertise, especially compared to older employees. Indeed, the negative effect of AI-based feedback was found to be lower for longer tenured employees (Tong et al., 2021).

Zooming in on the social awareness orientation of feedback, employees can benefit from peer feedback provided by technology, such as smart digital discussion boards or peer feedback systems (Dawson et al., 2018). Although, to our knowledge the relationship between STAARA and providing feedback oriented towards social awareness is not studied yet, we might assume that STAARA technology provides less feedback that could be used to improve social interactions as STAARA is mostly focused on providing content-related feedback to enable efficiency advantages (Brougham & Haar, 2017). Therefore, we expect that type of feedback orientation determines the influence on employees' need-supply fit. This leads to the following propositions:

Proposition 5a. The influence of STAARA technology on feedback leads to a small increase in needs-supplies fit for older employees because STAARA technology results in additional utility feedback (e.g. AI-based recommendations), which leads to an increase in the abilities component of successful aging at work for older employees. This influence is small because older workers have a relatively low need for utility-based feedback.

Proposition 5b. The influence of STAARA technology on feedback leads to a small decrease in needs-supplies fit for older employees because STAARA technology results in lower quality levels of utility feedback (e.g. opaque AI-based feedback) and thereby to decreased learning opportunities, which leads to a decrease in the abilities component of successful aging at work for older employees. This influence is small because older workers have a relatively low need for utility-based feedback.

Proposition 5c. The influence of STAARA technology on feedback leads to decrease in needs-supplies fit for older employees because STAARA technologies hamper the social awareness components of feedback delivery which leads to a decrease in the motivational component of successful aging at work for older employees.

2.3.6. Skill variety

Skill variety refers to tasks that require a wide range of skills. Older employees appear to benefit more from skill variety compared to younger employees due to their developed knowledge and experience (Zaniboni, Truxillo, & Fraccaroli, 2013). Jobs which require skill variety allow older employees to make use of their knowledge and experience and share this knowledge and experience with younger employees, thereby satisfying their generativity motives. As STAARA technologies may provide employees with the opportunity to gain new technical, communication, and ICT-related skills, STAARA technology is thought to lead to an increase in *skill variety* (Habraken & Bondarouk, 2017).

When we combine the insights from the literature on aging and STAARA technology it seems that STAARA technology might enable successful aging in terms of skill variety. STAARA Technology can lead to increases in skill variety. As older employees tend to benefit more from skill variety compared to younger employees. To illustrate, because of the automation, a call centre employee is required to spend more time on complicated client requests (compared to routine tasks), for which she needs both technical and communication skills. Hence, this change involves performing fewer different but more complex tasks, for which he or she deploys a wider variety of skills which allows older employees to draw on their experience.

Proposition 6. The influence of STAARA technology on skill variety leads to an increase in/restoration of demands-abilities fit for older employees when STAARA technologies results in increases in skill variety which leads to an increase in the ability component of successful aging at work.

2.3.7. Task variety

Task variety refers to performing many different tasks. Contrary to skill variety, task variety appears to be more beneficial for younger employees as this allows them to develop new skills and knowledge (Zaniboni, Truxillo, Fraccaroli, McCune, & Bertolino, 2014). As older employees are less motivated by growth and advancement task variety is deemed less important for older employees.

STAARA technology may lead to jobs with less task variety. For example, technology enables breaking down jobs into microwork

Table 1
Overview of changes in fit due to aging and technology.

Job characteristic	Influence of aging	Influence of technology	Proposition
Physical demands	Physical capability tends to decrease with age.	Technology tends to lead to less physical demands.	The influence of STAARA technology on physical demands leads to an increase in/ restoration of demands-abilities fit for older employees when STAARA technology leads to a reduction in physical demands which leads to an increase in the ability component of successful aging at work.
Mental demands	Although fluid intelligence tends to decrease, experience can usually compensate for this decrease especially for older employees with a high educational background, good health, that are engaged in complex and challenging work.	Technology can lead to lower mental demands when tasks are automated but when new technologies require reskilling this results in increased mental demands.	The influence of STAARA technology on cognitive demands leads to a decrease in demands-abilities fit for older employees with a low educational background, bad health, that are not engaged in complex and challenging work when new technologies require new skills which leads to a reduction in the ability component of successful aging at work.
Emotional demands	Emotion regulation and self-esteem tend to decrease, whereas fluid intelligence decreases. These effects compensate for one another.	Emotional demands tend to decrease when emotionally draining tasks are performed by technology.	The influence of STAARA technology on emotional demands leads to an increase in/ restoration of demands-abilities fit for older employees when emotionally draining tasks are automated which leads to an increase in the ability component of successful aging at work.
Autonomy and control	Older employees have more experience and can therefore benefit more from autonomy and control in terms of their job performance. However, older employees are less motivated by autonomy compared to younger workers as it provides opportunities for growth.	Technology can lead to lower levels of autonomy and control when decision-making is automated, but higher levels in autonomy and control with regards to when and where work is performed.	a: The influence of STAARA technology on autonomy leads to an increase in needs-supplies fit and demands-ability fit for older employees when it results in more freedom in where to work which leads to increases in the ability and motivational components of successful aging at work. b: The influence of STAARA technology on autonomy leads to a decrease in needs-supplies fit for older employees when it results in more freedom in how to work which leads to a reduction in the motivational component of successful aging at work. c: The influence of STAARA technology on autonomy leads to smaller decrease in needs-supplies fit for older employees compared to younger employees when STAARA technology results in simplification of tasks which leads to a smaller decrease in the motivational component of successful aging at work for older employees compared to younger employees.
Feedback	Job feedback becomes less important as growth motives tend to decrease.	Job feedback becomes easier and more frequent when technologies are available. The quality of feedback and the social components decrease.	a. The influence of STAARA technology on feedback leads to a small increase in needs-supplies fit for older employees because STAARA technology results in additional utility feedback (e.g. AI-based recommendations), which leads to an increase in the abilities component of successful aging at work for older employees. This influence is small because older workers have a relatively low need for utility-based feedback. b. The influence of STAARA technology on feedback leads to a small decrease in needs-supplies fit for older employees because STAARA technology results in lower quality levels of utility feedback (e.g. opaque AI-based feedback) and thereby to decreased learning opportunities, which leads to a decrease in the abilities component of successful aging at work for older employees. This influence is small because older workers have a relatively low need for utility-based feedback. c. The influence of STAARA technology on feedback leads to decrease in needs-supplies fit for older employees because STAARA technologies hamper the social awareness components of feedback delivery which leads to

(*continued on next page*)

Table 1 (*continued*)

Job characteristic	Influence of aging	Influence of technology	Proposition
			a decrease in the motivational component of successful aging at work for older employees.
Skill variety	Older employees benefit more from skill variety due to high levels of experience	The use of technology can lead to increases in skill variety.	The influence of STAARA technology on skill variety leads to an increase in/restoration of demands-abilities fit for older employees when STAARA technologies results in increases in skill variety which leads to an increase in the ability component of successful aging at work.
Task variety	Older employees benefit less from task variety as it is more focused on the development of new skills.	The use of technology can lead to micro-tasks, which are likely to reduce task variety.	The influence of STAARA technology on task variety leads to a smaller decrease in needs-supplies fit for older employees compared to younger employees when task variety is decreased which leads to a reduction in the motivational component of successful aging at work.
Social and relational aspects of work	As emotional goals tend to increase with age social support is more important for older employees.	Although STAARA technology can enable more opportunities to interact with other despite physical barriers, this requires new skills.	a: The influence of STAARA technology on social support leads to an increase in needs-supplies fit for older employees when it results in more opportunities to communicate which leads to increases in the motivational component of successful aging at work. b: The influence of STAARA technology on social support leads to a decrease in demands-abilities fit for older employees when the technology requires new skills to communicate which leads to a reduction in the ability component of successful aging at work.

(Parker & Grote, 2020), which can then be outsourced to gig work platforms. Berkers et al. (2022) showed that tasks in logistic warehouses became simpler and monotonous due to introduced robots. This would lead to a decreased number of different tasks (task variety).

In conclusion, older employees are less motivated by task variety compared to younger employees and STAARA technology can lead to jobs with less task variety. Therefore, we propose that the influence of STAARA technology on task variety leads to a smaller decrease in needs-supplies fit for older employees compared to younger employees.

Proposition 7. The influence of STAARA technology on task variety leads to a smaller decrease in needs-supplies fit for older employees compared to younger employees when task variety is decreased which leads to a reduction in the motivational component of successful aging at work.

2.3.8. Social and relational aspects of the job

Finally, according to the Socio-Emotional Selectivity theory (Carstensen, 1995) social motives (i.e., motives related to a preference for social interaction in the workplace) tend to increase with age (Kooij et al., 2011). Therefore, social support (i.e. the support that employees get from their supervisor and co-workers) appears to become more important for older employees (Carstensen, 1995; Truxillo et al., 2012). More specifically, older employees will place more importance on giving social support to fulfill their need for generativity (Kanfer & Ackerman, 2004).

STAARA technologies may also change the social and relationship aspects of the job. Parker and Grote (2020) describe how information and communication technologies (ICTs) can help to improve communication, making it easier to communicate with others at a distance, but also constrain relational aspects of work, because of constraints in virtual collaboration such as difficulties in coordination of distributed work.

As older employees find (giving) social support increasingly important and STAARA technology can both help and hinder social support the effect of STAARA technology we expect that the effect of social support on STAARA technology and aging can lead to increased needs-supplies fit as well as decreased demands-abilities fit. For example, research by Hill, Betts, and Gardner (2015) shows that older people indicated that although technology may help to overcome barriers of distance, they recognized that without the appropriate skills they may become more isolated as the use of these technologies grows. Therefore, we expect that when STAARA technology enables communication despite barriers such as distance this can enhance the needs-supplies fit of older employees. However, if communication technologies require new skills it can lead to reduced demands-abilities fit.

Proposition 8a. The influence of STAARA technology on social support leads to an increase in needs-supplies fit for older employees when it results in more opportunities to communicate which leads to increases in the motivational component of successful aging at work.

Proposition 8b. The influence of STAARA technology on social support leads to a decrease in demands-abilities fit for older employees when the technology requires new skills to communicate which leads to a reduction in the ability component of successful aging at work.

To summarize, we expect that STAARA technology can enable successful aging by enhancing person-environment fit for some job design features, whereas it can hinder successful aging by reducing person-environment fit for some other features. An overview of the effects that STAARA technology has on job demands and job resources and they in turn have on successful aging is provided in Table 1.

3. Enablers and constraints of the interplay between STAARA technology and successful aging at work

In the previous section, the interplay between STAARA technology and aging through job design has been discussed. Based on those propositions, we have sketched how STAARA technology could play a role in facilitating successful aging at work. However, these insights also illustrated ways how STAARA technology can have an adverse effect leading to undesirable consequences for older employees. In other words, STAARA technology can also enlarge the gaps between employees and the job design that comes due to age with ability-related gains and losses and changes in motivation. These propositions show that the influence of STAARA technology on successful aging at work is not always clear-cut and can depend on boundary conditions such as educational background, health, and type of work. The broader literature on PE-fit indeed suggests that fit is likely to be influenced by multiple other contextual aspects as well (Jansen & Kristof-Brown, 2006). In this section we will therefore explore enablers and constraints that can affect the interplay between STAARA technology and successful aging at work.

Contextual factors can influence the effects associated with STAARA technology (Bailey & Barley, 2020). The sociomateriality theory proposes that *interactions* between humans and technologies are focal and asserts that the technology's material features and human agency *together* shape organizational change (e.g., Leonardi, 2012). Based on this perspective, we should not treat STAARA technologies deterministically, in the sense that they dictate how (older) employees' work changes. Similarly, Parker and Grote (2020) advocated for a more proactive perspective on technology whereby attention is paid to how technology is adapted to better fit the needs, values, and competencies of individual employees. Therefore, we strive to outline important enablers and constraints that could facilitate an increased person-environment for older employees through STAARA technology. From this perspective, enablers are factors in the work context that facilitate a better fit between STAARA technology and aging whereby the application of STAARA technology is facilitated in such a way that it contributes to successful aging in the workplace. Constraints are those facets in the work environment that hinder or harm the fit in such a way that successful aging at work is diminished due to adverse effects of STAARA technology. For the sake of this research, we have grouped enabling factors and constraints into the individual, team, and organizational level.

3.1. Individual level

At the individual level, we focus on the active role of older employees themselves. Previous research had demonstrated that a good person-job fit is required for employees to age successfully at work. Job crafting (i.e., proactively making adjustments to one's job) can help to increase employees' current person-job fit (Kooij, 2015) and at the same time contributes to the ability and motivation to continue working (Kooij, Nijssen, et al., 2020; Kooij, Tims, & Kanfer, 2015). Based on the Selection Optimization and Compensation (SOC) model by Baltes and Baltes (1990) and insights into age-related changes to work (Kanfer & Ackerman, 2004), Kooij et al. (2015) identified three different forms of job crafting behaviors beneficial for older employees respectively accommodative crafting (aimed at regulating losses), developmental crafting (aimed at learning new skills and/or focused on personal growth), and utilization crafting (activities focused on optimizing existing skills and knowledge).

However, so far little attention has been paid to how (older) employees craft the impact of STAARA technologies (Parker & Grote, 2020). We argue that (older) employees can use job crafting strategies to actively engage in or withdraw from STAARA technology. For example, older employees could deviate or conform to specific (features of) STAARA technologies (Leonardi & Barley, 2010), actively look for and promote technologies that can help them for instance compensating for losses in physical capabilities or actively avoid new technologies that cause emotional stress (i.e., accommodative job crafting), look for projects in which their knowledge is used to inform algorithms (i.e., utilization job crafting), or actively look for training to help them gain knowledge and skills with regards to STAARA technologies (i.e., developmental job crafting). The job crafting strategies explained above could facilitate STAARA *technology appropriation*, meaning the consequences and implications of technologies are shaped by whether and how technologies are used by employees (Leonardi & Barley, 2010). This means that job crafting can help older employees deal with new technologies, but also that through job crafting older employees can help shape whether and how STAARA technology is used. When many older employees decide to avoid using a certain technology this can lead to a company opting out of this technology, whereas when many older employees decide to use new technology in a different way than was intended the design of the technology can be adapted to better fit its actual use.

3.2. Team level

At the team level, line-managers play an important role in how HR practices as intended by the organization are actually implemented within the organization (Bos-Nehles, 2010; Nishii, Lepak, & Schneider, 2008). Moreover, the line-manager can establish a positive workgroup climate in which employees of all ages feel appreciated (Boehm, Kunze, & Bruch, 2013). This implies that the line-manager plays a crucial role in establishing an 'aging friendly' work environment within a team. Line-managers can achieve such an environment by providing equal opportunities to employees of all ages and by pointing out the HR practices and policies that are available within the organization that promote age diversity (Boehm et al., 2013).

Additionally, line-managers play an important role in creating a psychological safety climate which is crucial for learning to work

with new technologies. Congruent communication and intentional intervention by the line-manager are needed to achieve such a climate. Line-managers should encourage employees to speak up about the problems they face with STAARA technology so that the team can jointly look for solutions that promotes organizational learning (Edmondson & Lei, 2014).

Finally, research has shown that leadership can reduce the impact of techno-invasion on emotional exhaustion, but aggravate the impact of techno-overload on emotional exhaustion (Bauwens, Denissen, Van Beurden, & Coun, 2021), help employees to maintain their work performance in a virtual work environment (Bartsch, Weber, Büttgen, & Huber, 2020) and support employees to deal with technological insecurity by providing support for strengths use and friendship opportunities (Goetz & Boehm, 2020).

As line-managers play an important role in the delivery of HR practices and the establishment of an age diversity and psychological safety climate as well as in dealing with technostress, it seems reasonable to assume that line-managers also play an important role when it comes to the way STAARA technology is or will be implemented within teams and how this affects employees of different ages. To facilitate a better fit between STAARA technology and aging a manager should take age related challenges regarding technology into account so that STAARA technology fits better with the needs of older employees. By having an open culture in which issues related to aging are openly discussed supervisors can easily recognize what type of technologies are needed to facilitate their aging team and might adapt existing technologies to fit with the needs of the aging employees within the team.

3.3. Organizational level

At the organizational level, HR practices aimed at facilitating individual employees and organizational climate are important to maintain person-job fit for older employees (Kooij, Nijssen, et al., 2020). HRM practices, such as information sharing, management support, reward and recognition, adequate training, and participation, positively affect the level of STAARA technology adaptation by employees (Rubel, Kee, & Rimi, 2020). However, current research did not consider the age of employees and therefore we use insights from literature regarding HR practices that can be used to facilitate successful aging at work.

Kooij, Jansen, Dikkers, and de Lange (2014) distinguished four bundles of HR practices for older employees, namely development, maintenance, utilization, accommodative, and utilization practices, all relevant employees to deal with age related losses. These bundles of HR practices are based on the Selection Optimization and Compensation (SOC) model (Baltes, Staudinger, & Lindenberger, 1999) suggesting that employees allocate their resources in line with four major life goals namely; growth, maintenance, recovery, and the regulation of loss.

The first bundle, developmental practices (e.g., training and promotion) are aimed at growth and help employees to improve their functioning at work (Kooij et al., 2014), which has a positive effect on work outcomes for older employees (Pak et al., 2020). Older employees indicate that they would like to receive more training to facilitate the learning of skills related to technology (Lee, Czaja, & Sharit, 2008). Therefore, we suggest that developmental practices could be used to train employees of all ages to deal with new technologies but might need to be adapted to older employees to facilitate successful aging at work. Wolfson, Cavanagh, and Kraiger (2014) suggest that technology-based training for older employees should have a high degree of structure, provide feedback to participants, include metacognitive cues (e.g., paraphrasing), be based on the principles from cognitive load theory and cognitive theory of multimedia learning (e.g., make use of the worked example, segmentation, and coherence effect), and have an interface that is easy to use that remains consistent throughout the course.

Second, maintenance practices (e.g., performance appraisal and ergonomic adjustments to the workplace) help older employees maintain their functioning at work despite changes related to the aging process (Kooij et al., 2014). In some instances these HR practices and technology can get integrated, for example when STAARA technology helps (older) employees deal with the physical demands of their job this type of STAARA technology can be considered a maintenance practice. Other types of maintenance practices such as performance appraisals and performance pay can help older employees stay motivated when learning to deal with new technologies.

Third, utilization practices (e.g., participation and task enrichment) help older employees regain their functioning (i.e., recovery) at work after a loss in their ability or motivation by making better use of the specific knowledge and strengths of older employees (Kooij et al., 2014). Reverse or reciprocal mentoring might be particularly useful in helping older employees adapt to technology (Marcinkus Murphy, 2012). In these types of programs, technologically savvy younger employees can help older employees adapt to STAARA technology, whereas older employees can share their knowledge and expertise with younger employees.

Last, accommodative practices (e.g., demotion and part-time work) are aimed at the regulation of loss and can help older employees to function at a lower level when the old level of functioning is no longer attainable (e.g., due to age-related changes). Accommodative practices could be helpful as they give older employees more time to recuperate when learning to deal with new technologies.

Moreover, Boehm et al. (2013) distinguish five important practices which organizations can use to foster age diversity, namely age-neutral recruitment activities, equal access to training and career progression opportunities such as promotion, offering training to managers on how to deal with an age-diverse workforce, and promoting an organizational friendly culture. To foster age diversity with regards to STAARA technology it is important that all employees get access to technologies regardless of their age. Algorithms can be used to make decisions on recruitment, training, and promotions regardless of age. However, as algorithms are made by humans and make use of historical data they can still include or even strengthen bias (see for example Díaz, Johnson, Lazar, Piper, & Gergle, 2018).

The examples above illustrate that through HR practices and organizational climate organizations can support their employees in adopting STAARA technology. By taking a human-centered design approach, organizations can also adapt technologies to suit employees, rather than dramatically changing work (Parker & Grote, 2020). Organizations could do this by adopting STAARA technologies that match with the aging workforce (i.e., to improve person-environment fit) and adapting them to fit with the organizational context.

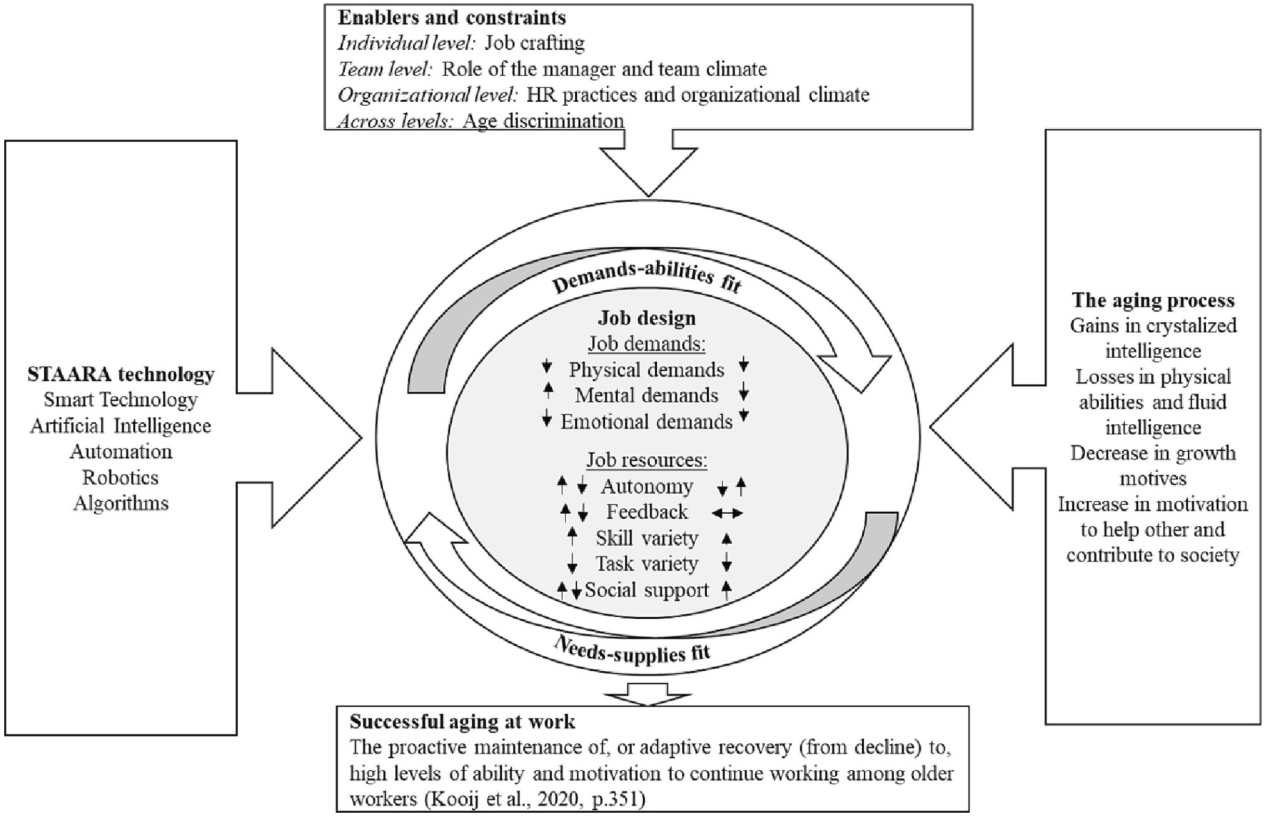

Fig. 1. Conceptual model of the integration between technology and aging through job design.

3.4. Across levels

Some enablers and constraints play a role at the individual, group, and organizational level such as age discrimination. Although age discrimination can be directed at employees of all ages, it is mostly experienced by people who enter the labor market and older employees (Wood, Wilkinson, & Harcourt, 2008). Age discrimination at work occurs based on stereotypes that people have of older employees (e.g., older employees are less motivated to work). Even though there is no empirical evidence for most of these stereotypes (Ng & Feldman, 2012) many people (including older employees themselves) share these beliefs which results in lower employability of older employees (Ahmed, Andersson, & Hammarstedt, 2012; Peters, Van Der Heijden, Spurk, De Vos, & Klaassen, 2019). At the personal level, the self-internalization of these stereotypes can be harmful to both cognitive and physical health (Levy, 2003). On the team and organizational level stereotyping, bias, and discrimination can lead to an age discrimination climate in which older employees are treated unfairly (Kunze, Boehm, & Bruch, 2011). With regard to STAARA technology, the stereotypical older employee is thought to be less interested and able to adapt to new technologies (Henkens, 2005). However, despite this age stereotype older employees do not appear to be more affected by techno-stress compared to younger employees (Hauk, Göritz, & Krumm, 2019). Therefore, it is important to avoid differential treatment based on age with regards to STAARA technologies.

Finally, factors at all levels of the organization can influence the attributions older employees attach to technology which in turn are important for the degree to which STAARA technology will be used by older employees (Nishii et al., 2008). When older employees perceive that technologies are implemented to support their health, they will likely be more receptive to these technologies than when these technologies are perceived to be implemented as a way to reduce costs. Organizations should pay attention to how technologies are implemented to create favourable attributions, which can be done by ensuring a high degree of distinctiveness, consistency, and consensus regarding a practice (e.g., STAARA technology).

4. Discussion

The aim of this article was to integrate insights from both the aging literature and the STAARA technology literature to identify the ways STAARA technology can afford changes in job design and how these changes in job design are related to successful aging at work. In doing so, we have identified the job design features for which STAARA technology can improve or reduce person-environment fit (i.e., needs-supply fit and demands-ability fit) for older employees and thereby help or hinder successful aging at work. Moreover, we have identified a number of enablers and constraints on the individual, team, and organizational level that can affect the degree to which STAARA technology and successful aging lead to enhanced or reduced person-environment fit. In Fig. 1 we have outlined a conceptual model to guide future research. In this last section, we will outline a number of avenues for future research and implications for practice based on this figure.

4.1. Recommendations for future research: a research agenda

Based on this conceptual review we suggest that there are several important research avenues for future research. Below we will outline a number of suggestions with which we encourage researchers to examine the research propositions we formulated on the combined effect of STAARA technology and successful aging at work. Such studies can create further insight into how STAARA technology can hinder or help successful aging at work.

First, given that successful aging at work unfolds over time (Wang et al., 2017), longitudinal approaches would be most suitable to test these propositions (Bohlmann et al., 2018). Second, it is important to note that aging trajectories differ (Morack et al., 2013) and are influenced by contextual factors (De Vos, Van der Heijden, & Akkermans, 2020). Therefore, we would encourage researchers to address the enablers (e.g., job crafting, supervisor support, and HR practices) and constraints (e.g., age discrimination) as moderators in models that address the relationship between STAARA technology and outcomes related to successful aging at work (e.g., ability and motivation to continue working). It is important to acknowledge that these enablers and constraints can interact and together determine how STAARA technology influences successful aging at work through job design. For example, HR practices can signal to employees what the organization finds important which can in turn guide job crafting behaviors. On the other hand, age discrimination can undermine the effectiveness of job crafting and signal to older employees that job crafting with regard to STAARA technology is not desired.

Third, previous research has mostly focused on calendar age as a predictor of successful aging at work (De Lange et al., 2020; Le Blanc, Van der Heijden, & Van Vuuren, 2017). However, age is only a proxy of age-related changes (Kooij, 2015) and as people become more different from another as they age (Bal et al., 2012; Bohlmann et al., 2018) it is not always the most appropriate proxy (De Lange et al., 2020; Le Blanc et al., 2017). Aging at work is a multidimensional process of gains and losses (Kooij et al., 2008) that can be characterized by calendar age, functional age (e.g., health), subjective age, organizational age, and life-span age (e.g., major life events; Sterns & Doverspike, 1989). Le Blanc et al. (2017) have shown that from these five indicators of age life-span age had the strongest association with the ability to continue working and organizational age had the strongest association with the motivation to continue working. This suggests that to better understand how to facilitate successful aging at work through STAARA technology an operationalization of age that goes beyond calendar age is needed and could provide further insights into the complex relationship between STAARA technology and successful aging at work.

Fourth, for the sake of simplification we have combined different advanced technologies under the STAARA umbrella in this article (Brougham & Haar, 2017). However, it is possible that different STAARA technologies evoke different effects among older employees. For instance, employees can see the added value of a Robot helping them to lower their physical demands as a nurse. However,

decisions that will be made regarding patients' medicines based on Algorithms can be experienced as a danger for patients and thus categorized as harmful. In addition, the (physical) form or embodiment of these advanced technologies, varying between physical robots and computer bots, are important for developing trust among older individuals (Glikson & Woolley, 2020). For example, studies indicate that elderly participants were more positive about physical humanoid robots compared to computer screens (Shim & Arkin, 2016) and specifically responded positively to human-like features in robots (Zhang et al., 2010). These examples illustrate that different technologies (i.e., Smart Technology, Artificial Intelligence, Automation, Robotics, and Algorithms) can have a different effect on the same employee. Therefore, we suggest that researchers should compare whether these propositions hold for a variety of STAARA technologies.

Fifth, we believe that we should not treat STAARA technology as a tool that determines how employees work. Rather, the use of STAARA technology is shaped by the social context in which it is introduced, and the way these technologies are used in practice can also shape the STAARA technology. This sociomaterial perspective posits that technology consists of material and social features that mutually influence each other (Leonardi & Barley, 2010). It would therefore be an interesting avenue for future research to study how the aging process influences the choice of STAARA technologies in organizations. For example, do organizations with an older workforce choose to adopt other technologies? Furthermore, older employees could make use of other material features of a STAARA technology, and thereby shape their jobs differently than younger employees – for instance when they use lifting technologies not only for lifting patients (as its intended use) but also for lifting and transporting goods across departments. Finally, aging employees could be involved in the (early) development process of STAARA technology to create age inclusive technology and thereby also shape their own job design once these technologies are introduced at work.

4.2. Practical implications

This conceptual review also has several implications for practice. The propositions formulated in this paper suggest that organizations can use STAARA technology to facilitate successful aging at work when technologies reduce the physical and/or emotional demands of the work and/or increase autonomy and control, skill variety, and/or social support. Moreover, we expect that organizations can further enhance these fits between STAARA technology and aging by stimulating job crafting behaviors, by offering HR practices aimed at individualization or inclusion of older employees, and by creating an open culture in which age discrimination does not take place. However, our propositions suggest that technology can also hinder successful aging at work (for some) when it leads to increases in mental demands, and decreases in autonomy and control, and/or social support. We expect that age discrimination can enhance this negative effect even further. Therefore, we urge practitioners to consider carefully how they will implement and use new technologies and consider the effects they may have on the aging trajectories of their employees. Furthermore, we discussed the interactions between technology and job design (demands and resources), and we repeatedly state that the (possible) consequences and effects are mainly related to the way organizations set up and organize their technology. STAARA technology offers many possibilities, however implementation of those techniques can also have adverse effects due to improper implementation. Therefore, HRM practitioners should play an important role in deploying STAARA technologies.

CRediT authorship contribution statement

Karen Pak: Conceptualization, Investigation, Visualization, Writing - original draft, Writing - review & editing. **Maarten Renkema**: Conceptualization, Formal analysis, Investigation, Writing - original draft, Writing - review & editing. **Daphne T.F. van der Kruijssen**: Conceptualization, Formal analysis, Investigation, Visualization, Writing - original draft, Writing - review & editing.

Data availability

No data was used for the research described in the article.

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