

Economic skills obsolescence

Angela Messioui

Propositions belonging to the dissertation:

Economic skills obsolescence

by

Angela Messioui

Maastricht University

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- 1 Perceived economic skills obsolescence reduces employees' perceptions of development opportunities at work through psychological resource loss (Chapter 2).
- 2 Perceived economic skills obsolescence has adverse consequences for employees' perceptions of their health, wellbeing and job security (Chapters 3, 4 and 5).
- 3 Investments in employees' development opportunities at work prevent sickness absence (Chapter 4).
- 4 Perceived economic skills obsolescence and sickness absence mutually reinforce each other over time (Chapters 3 & 5).
- 5 Economic skills obsolescence should be understood as an ongoing process rather than a static condition.
- 6 In addressing economic skills obsolescence across career stages, a one-size-fits-all approach is ineffective.
- 7 Formal training alone is insufficient to maintain sustainable employability.
- 8 Skills development and sickness absence should not be treated as separate domains in HR practice.
- 9 Scientific research benefits from collaboration between academia and professional practice.
- 10 Practical experience and academic knowledge strengthen each other when treated as complementary sources of insight.

Economic skills obsolescence

Angela Henriëtte Aïchaa Messioui

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Economic skills obsolescence

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by

Angela Henriëtte Aïchaa Messioui

Supervisor

Prof. Dr. Andries de Grip, Maastricht University

Co-supervisors

Dr. Jos Sanders, HAN University of Applied Sciences

Prof. Dr. Tinka van Vuuren, Open Universiteit

Assessment committee

Prof. Dr. Tim Huijts (Chair) , Maastricht University

Prof. Dr. Dorien Kooij, Tilburg University

Dr. Annemarie Künn-Nelen, Maastricht University

Prof. Dr. Hans de Witte, KU Leuven

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Contents

Chapter 1.

Introduction

1.1 Motivation and relevance	3
1.2 Theoretical framework	5
1.2.1 Job Demands–Resources and Conservation of Resources theory	7
1.3 Aim, methodology and structure	8
1.4 Outline dissertation	10
References	12

Chapter 2.

Economic skills obsolescence and development

opportunities at work: the role of age and psychological resource

2.1 Introduction	17
2.2 Theoretical background and hypotheses	18
2.2.1 Economic skills obsolescence and development opportunities at work	18
2.2.2 Psychological resources as mediators	20
2.2.3 Age as a moderating factor	23
2.3 Method	26
2.3.1 Sample and data	26
2.3.2 Measures	27
2.3.3 Statistical analysis	28
2.4 Results	29
2.4.1 Descriptive statistics and Pearson correlations	29
2.4.2 Parallel mediation analysis	30
2.4.3 Age-moderated mediation analysis	32
2.5 Discussion	35
2.5.1 Theoretical implications	37
2.5.2 Limitations and future research	38
References	39

Chapter 3.

Economic skills obsolescence and sickness absence among older employees

3.1 Introduction	45
3.2 Theoretical background and hypotheses	47
3.2.1 Dual outcomes and cross-pathways	48

3.2.2 Health-impairment process	48
3.2.3 Motivational process	49
3.3 Method	50
3.3.1 Study design	50
3.3.2 Measures	52
3.3.3 Statistical analysis	54
3.4 Results	55
3.4.1 Descriptive statistics and Spearman correlations	55
3.4.2 Hypotheses testing	57
3.5 Discussion	60
3.5.1 Implications	60
3.5.2 Strengths, limitations and future research	61
References	63
Appendices	67

Chapter 4.

Economic skills obsolescence and development
opportunities at work: the relationships with sickness
absence and work engagement

4.1 Introduction	71
4.2 Theoretical background and hypotheses	72
4.2.1 Job Demands–Resources (JD–R) theory	72
4.2.2 Economic skills obsolescence as a job demand	73
4.2.3 Development opportunities at work as a job resource	74
4.2.4 Sickness absence frequency	75
4.2.5 The demands pathway	75
4.2.6 The resources pathway	76
4.3 Method	78
4.3.1 Data collection and sample	78
4.3.2 Measures	79
4.3.3 Statistical analysis	80
4.4 Results	82
4.4.1 Type of obsolete skills by age group	82
4.4.2 Descriptive statistics and Pearson correlations	82
4.4.3 Hypotheses testing	84
4.5 Discussion	86
4.5.1 Limitations and suggestions for future research	89
4.5.2 Recommendations for practice	90
References	92

Chapter 5.

Sickness absence and job insecurity: the roles of technical and economic skills obsolescence

5.1 Introduction	99
5.2 Theory and hypotheses	101
5.2.1 Job insecurity	101
5.2.2 Sickness absence	102
5.2.3 Sickness absence and job insecurity	102
5.2.4 Skills obsolescence as mediator	104
5.3 Method	106
5.3.1 Participants and procedure	106
5.3.2 Measures	107
5.3.3 Statistical analysis	109
5.4 Results	110
5.4.1 Descriptive statistics and Spearman correlations	110
5.4.2 Hypotheses testing	111
5.5 Discussion	112
5.5.1 Limitations and future research	115
5.5.2 Practical implications	116
5.6 Conclusion	117
References	119

Chapter 6.

Conclusions and discussion

6.1 Summary of the empirical findings	127
6.2 General conclusions	131
6.3 Future research	134
References	136

Impact 137

Conceptual and empirical contributions	137
Theoretical implications for JD-R and COR theory	138
Implications for work, sickness absence and return-to-work	139
Professional context and dissemination	139

Summary 141

Samenvatting 143

About the author 145

ROA dissertation series 146

1

Introduction

1.1 Motivation and relevance

Technological and organisational developments are reshaping the nature of work at a high pace. Digital technologies and automation are changing how work is organised, how tasks are performed, and which skills are demanded from employees (Acemoglu & Restrepo, 2019; Deming & Noray, 2020). As job requirements evolve, the skills that employees rely on may lose their value in the labour market more quickly than before (Aljofan et al., 2024; Allen & De Grip, 2012; Rikala et al., 2024). This creates pressure on employees to keep up, and on organisations to ensure that their workforce remains employable.

Across sectors, maintaining the relevance of employees' skills in relation to evolving systems, tools, and workflows has become increasingly challenging in the context of digitalisation and organisational change (Cedefop, 2024; OECD, 2025). Job tasks are updated; processes are redesigned, and new technologies are integrated into everyday work. When these changes occur rapidly, employees may perceive that their existing skills lose value in relation to changing job requirements, even when they previously performed well. This perceived loss of value of employees' skills due to technological or organisational changes is referred to in this dissertation as economic skills obsolescence. This not only affects employees' productivity, but also their job security, motivation, and health (Allen & De Grip, 2012; Cascio & Montealegre, 2016; Parry & Battista, 2019; Rikala et al., 2024). However, organisations often observe these signals late, typically not earlier than when employees report strain, performance issues, or difficulties coping with new demands.

These developments highlight the need to understand how employees perceive changing skill demands and how organisations respond. European labour market analyses show that many occupations now require more frequent skill updating, while opportunities for training and development remain unevenly distributed (OECD, 2025). Employees who struggle to keep pace with changing skill demands in their job may withdraw from learning, perceive stress, and develop concerns about losing their job. In addition, sickness absence removes employees from the day-to-day flow of work, interrupting exposure to new technologies, updated procedures, and informal learning opportunities. This may increase the difficulty of returning to a job that has continued to evolve during employees' absence.

My own professional experience in HR reflects these challenges. Employees returning from sickness absence often face new digital systems, reorganised teams, or updated procedures, introduced while they were away from work.

Others perceive pressure because the pace of organisational change exceeds the time and support available for learning. These situations frequently lead to uncertainty, reduced motivation, and health complaints. At the same time, organisations often lack clear insight into how economic skills obsolescence, development opportunities, and sickness absence interact in practice.

Although technological change is widely recognised as an important driver of workforce transformation, less is known about how employees perceive economic skills obsolescence and how this relates to their health, motivation, and work participation. Existing research on sickness absence has paid limited attention to the relationships between economic skills obsolescence, sickness absence, and development opportunities. These relationships are unlikely to follow a strictly linear pattern. Economic skills obsolescence may contribute to disengagement, reduced learning opportunities, and sickness absence, while sickness absence itself and decreased development opportunities may further reinforce perceptions of economic skills obsolescence over time. These intertwined processes highlight the need for research that connects employees' economic skills obsolescence, health, and employability in the context of organisational and technological change.

This dissertation addresses these questions from a multi-disciplinary perspective, by examining how perceived economic skills obsolescence develops within changing work environments and how this relates to employees' development opportunities at work and sickness absence. Across the empirical chapters, this dissertation examines how perceived economic skills obsolescence relates to employees' psychological resources, motivation, and health-related outcomes, and how these processes vary across age groups, datasets, and work contexts.

Age is particularly relevant in this discussion, as concerns about economic skills obsolescence are often linked to ageing, particularly in workplaces characterised by rapid technological change. Older employees are frequently assumed to perceive greater difficulty adapting to new systems, learning requirements, or changing job requirements. However, this dissertation approaches age as a factor that may strengthen, weaken, or alter the relationships between economic skills obsolescence and its underlying psychological and work-related outcomes, recognising that these experiences differ across individuals and work contexts.

1.2 Theoretical framework

The concept of skills obsolescence originates in the human capital literature. Skills lose their value when they are not updated or when the context in which they were acquired no longer aligns with the demands at work. Foundational human capital research shows that the economic value of human capital depends not only on accumulated experience but also on the technological and organisational setting in which that experience has been gained (Becker, 1964; Mincer, 1974). Recent studies indicate that skills obsolescence is increasingly observed in digitally transforming workplaces, where technological innovations reshape job tasks and alter required knowledge (Parry & Battista, 2019; Rikala et al., 2024). Career interruptions reduce the value of human capital, which is reflected in lower wages upon re-entry (Mincer & Ofek, 1982). Neuman and Weiss (1995) extended this reasoning through the idea of schooling vintage, proposing that skills acquired under earlier technological regimes depreciate when innovation reshapes job tasks. Pazy (1994) argued that experiences of skills obsolescence differ across career stages because opportunities for learning, updating, and career mobility vary throughout the career.

De Grip and Van Loo's (2002) review synthesises this body of literature and distinguishes two forms of skills obsolescence: technical and economic skills obsolescence. *Technical skills obsolescence* refers to the ageing and deterioration of skills when they are not used, for example when prolonged periods without practice reduce proficiency in specific tasks or tools, or when illness or injury affects employees' ability to apply their skills. *Economic skills obsolescence* refers to the loss of value of employees' skills due to technological or organisational changes that alter job requirements. Both forms of skills obsolescence occur in modern workplaces and are examined in this dissertation, although the focus lies on economic skills obsolescence because it captures how employees perceive changing skill requirements. Technical skills obsolescence is examined only in the context of sickness absence, where periods away from work may limit exposure to updated work practices, thereby increasing the risk of economic skills obsolescence, and may also accelerate the deterioration of task-specific skills, reflecting technical skills obsolescence.

Previous research has measured economic skills obsolescence both objectively and subjectively. Objective indicators include wage depreciation, productivity patterns, and flattened experience-earnings profiles when employees' skills no longer match new technologies (Mincer & Ofek, 1982; Neuman & Weiss, 1995; Rosen, 1975). Subjective indicators capture employees' evaluations that their

skills have become outdated due to changes in work processes or technologies (Allen & De Grip, 2012).

In this dissertation, perceived economic skills obsolescence refers to employees' assessment that their existing skills have lost value over time due to technological, organisational, or labour market changes that alter job requirements. The concept reflects a process of skill depreciation in which previously acquired skills become less valuable in evolving work contexts. Although measured as a perception at a given moment, economic skills obsolescence reflects an underlying dynamic process that unfolds as job requirements evolve faster than employees' opportunities to maintain or update their skills. This definition aligns with the operationalisation used across the empirical chapters and reflects both the depreciation of skills and employees' subjective perception of this process, which shapes their psychological responses to changing job demands.

Within the broader skills literature, economic skills obsolescence is conceptually related to skills mismatch, skill gaps, and person-job fit. Skills mismatch refers to discrepancies between employees' skills and those required in the job and labour market, whereas skill gaps usually reflect employers' assessments that employees lack specific skills for current roles (McGuinness et al., 2018; Cedefop, 2018). Person-job fit refers to the degree of alignment between employees' abilities and the demands of their job, or between employees' needs and what the job provides (Kristof-Brown et al., 2005).

Building on a dynamic person-job fit perspective, economic skills obsolescence reflects a process of external depreciation in which previously valuable skills gradually lose value due to technological, organisational, and labour market changes over time (Neuman & Weiss, 1995; Dorenbosch et al., 2012). As job requirements evolve, employees may increasingly perceive a declining fit between their existing skills and current work requirements. Economic skills obsolescence, therefore, reflects more than a static mismatch at a single moment in time. Instead, it captures a dynamic process through which employees experience a gradual loss of value of their skills, which may undermine sustainable employability when person-job fit is not restored through development, mobility, or work redesign interventions. In contrast to concepts such as skills mismatch and person-job misfit, which primarily capture discrepancies at a given moment, economic skills obsolescence captures the process through which previously relevant skills lose value as job requirements evolve over time. Economic skills obsolescence may therefore contribute to skills mismatch, skill gaps, and reduced person-job fit before these discrepancies become fully vis-

ible or formally recognised (Follmer et al., 2018; McGuinness et al., 2018; Rikala et al., 2024).

1.2.1 Job Demands–Resources and Conservation of Resources theory

To examine how employees perceive these developments, this dissertation draws on two complementary theoretical frameworks: the Job Demands–Resources (JD–R) model (e.g., Demerouti et al., 2001) and Conservation of Resources (COR) theory (e.g., Hobfoll, 1989, 2001). JD–R provides a structural framework for understanding relationships between job demands, resources and work-related outcomes, whereas COR theory explains the underlying dynamics of resource loss and gain. Together, these frameworks offer a conceptual basis for understanding how changing job requirements relate to learning, work engagement, health and perceptions of future prospects.

In this dissertation, perceived economic skills obsolescence is positioned within the JD–R framework as a demand-related experience that emerges when employees perceive increasing difficulty in maintaining their skills valuable in response to changing job requirements. It reflects the strain associated with adapting and maintaining performance under changing skill expectations. Within this perspective, perceived economic skills obsolescence captures how changing job requirements become psychologically meaningful for employees and may require sustained effort to adapt.

Development opportunities at work are positioned as job resources that may support employees in adapting to changing skill requirements. In line with the JD–R framework, work engagement and burnout represent motivational and health-related outcomes, while sickness absence is examined as a behavioural outcome reflecting reduced work participation. Together, these outcomes align with the motivational and health-impairment processes described in JD–R theory.

From a COR perspective, perceived economic skills obsolescence reflects a decline in the value and usefulness of skills that employees may perceive within changing work environments. COR theory suggests that resource loss may emerge when employees perceive reduced capacity to maintain relevant skills over time. This may be reflected in lower learning-related psychological resources such as learning attitude, learning efficacy and mastery. COR theory further helps explain why periods of sickness absence may contribute to higher job insecurity when employees perceive that changes at work have reduced

the value of their existing skills. By combining JD–R and COR theory, this dissertation conceptualises perceived economic skills obsolescence as a process through which changing job requirements relate to employees' development, health and work participation.

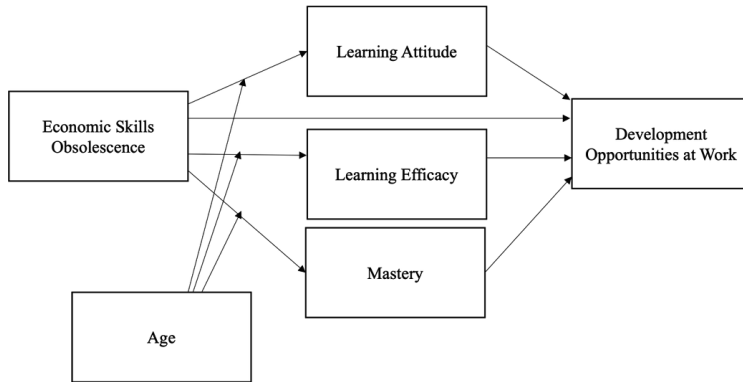
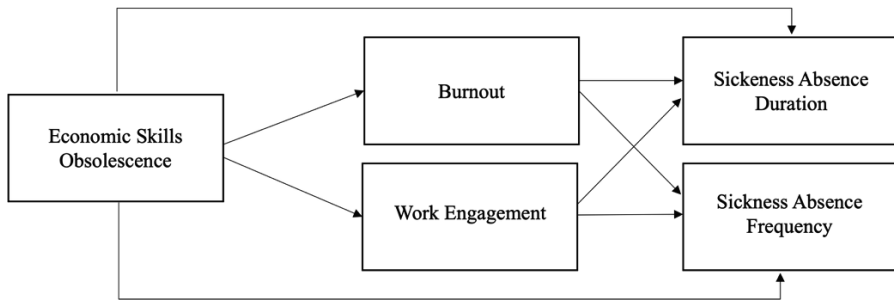
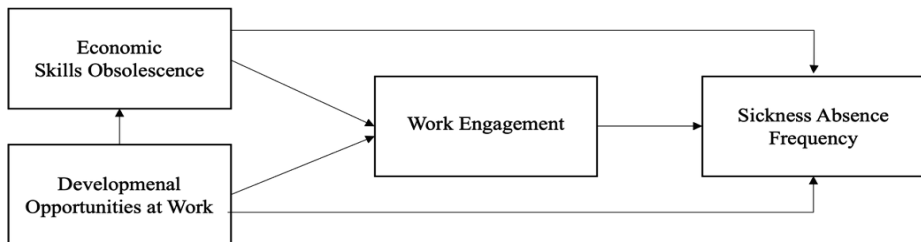
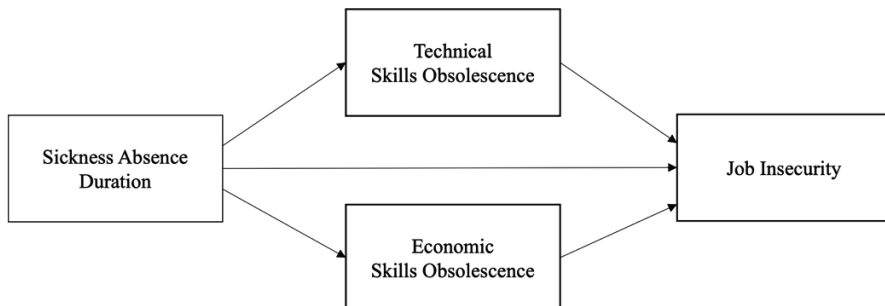
1.3 Aim, methodology and structure

The aim of this dissertation is to examine how employees perceive economic and technical skills obsolescence in changing work environments and how these perceptions relate to development opportunities at work, psychological resources, work engagement, burnout, sickness absence and job insecurity.

Across the four empirical chapters, relationships are examined from multiple perspectives, allowing for differences in directionality depending on the outcome, context and analytical focus. This reflects the assumption that perceived economic skills obsolescence may function both as an antecedent of work-related outcomes, such as work engagement, burnout, sickness absence and job insecurity, and as a consequence of changing working conditions and employees' access to resources, depending on the temporal ordering of variables. Relationships between skills obsolescence, resources and other work outcomes are therefore treated as potentially reciprocal rather than strictly unidirectional.

The four empirical studies in this dissertation examine not only whether these associations exist, but also through which psychological and behavioural mechanisms these relationships unfold. Mediation analyses are used to examine how perceived economic skills obsolescence relates to outcomes such as development opportunities, sickness absence and job insecurity through intermediate processes including psychological resources, work engagement and burnout. These analyses estimate total, direct and indirect associations between variables. Consistent with established conventions in mediation analysis, statistical results are described in terms of effects without implying causal relationships (Preacher & Hayes, 2008). Non-parametric bootstrapping was used to estimate confidence intervals for indirect pathways across the empirical chapters.

Figures 1.1 to 1.4 present the conceptual models guiding the four empirical chapters, specifying how economic skills obsolescence relates to employees' learning resources, motivation and health outcomes through psychological or behavioural mechanisms. The four figures summarise the relationships tested in each chapter and show how the four empirical studies build on one another.

Figure 1.1 Conceptual model of Chapter 2**Figure 1.2** Conceptual model of Chapter 3**Figure 1.3** Conceptual model of Chapter 4**Figure 1.4** Conceptual model of Chapter 5

1.4 Outline dissertation

Chapter 2 examines how economic skills obsolescence relates to employees' perceptions of development opportunities at work and to what extent this relationship is explained by three psychological resources: learning attitude, learning efficacy and mastery, with age as a moderator. The chapter tests a moderated mediation model with multiple mediators, in which economic skills obsolescence reduces psychological resources that subsequently shape whether employees continue to perceive development opportunities in their work. Using longitudinal survey data from telecommunications employees, we estimate a moderated mediation model and test direct, indirect and conditional indirect effects with non-parametric bootstrapping.

The findings show that economic skills obsolescence is indirectly and negatively related to development opportunities at work through learning attitude and mastery, and positively through learning efficacy, indicating a differential and partly counterintuitive role of learning efficacy in this process. Age strengthens the negative associations between economic skills obsolescence and both learning attitude and learning efficacy. This chapter contributes by identifying the psychological mechanisms through which economic skills obsolescence affects perceived development opportunities and by showing that older employees are more vulnerable to resource loss in this process.

Chapter 3 focuses on older employees and examines how economic skills obsolescence relates to both the frequency and duration of sickness absence through work engagement and burnout. This chapter deepens the analysis by demonstrating how employees' perception of skills obsolescence is linked to health-related outcomes in later career stages, where changes in job requirements may be particularly consequential. Using longitudinal data from the Dutch Study on Transitions in Employment, Ability and Motivation (STREAM), a large-scale panel study conducted by TNO, we estimate a multiple mediation model with structural equation modelling, followed by non-parametric bootstrapping to test direct and indirect effects. The results show that economic skills obsolescence at baseline is positively related to burnout and negatively related to work engagement at follow-up, and that both pathways relate to higher absence frequency and longer absence duration. This chapter contributes by showing that economic skills obsolescence is associated with subsequent absence behaviour through increased burnout and reduced work engagement.

Chapter 4 examines how economic skills obsolescence and development opportunities relate to sickness absence. We estimate a mediation model in which economic skills obsolescence is associated with higher absence frequency through reduced work engagement, and in which development opportunities at work are associated with lower perceived economic skills obsolescence and lower sickness absence frequency, both directly and indirectly via higher work engagement. Using cross-sectional survey data from a large Dutch telecommunications organisation, we estimate the direct and indirect pathways with structural equation modelling and non-parametric bootstrapping. The findings show that economic skills obsolescence corresponds with higher sickness absence frequency through lower work engagement, while development opportunities at work function as an important resource that increases work engagement, reduces perceived economic skills obsolescence and lowers sickness absence frequency. This chapter contributes by identifying the role of workplace learning conditions in shaping employees' responses to changing skill demands and their sickness absence behaviour.

Chapter 5 examines whether sickness absence contributes to job insecurity through economic and technical skills obsolescence. Using longitudinal survey data from a Dutch telecom organisation, we estimate a multiple mediation model with regression-based mediation and non-parametric bootstrapping to test direct and indirect effects. The conceptual model proposes that absence duration increases economic and technical skills obsolescence, which subsequently shapes employees' perceptions of job insecurity. The results show that economic skills obsolescence, but not technical skills obsolescence, mediates the relationship between sickness absence and job insecurity. This chapter contributes by demonstrating that sickness absence initiates a resource loss process in which missed technological and organisational developments increase economic skills obsolescence and, in turn, job insecurity.

Chapter 6 integrates the findings of the empirical chapters. It summarises the main conclusions, discusses the contributions of the dissertation, considers methodological and theoretical limitations and outlines avenues for future research.

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2

Economic skills obsolescence and development opportunities at work: the role of age and psychological resources

This chapter is a slightly adjusted version of a paper co-authored with Jos Sanders that is forthcoming in *Gedrag & Organisatie*:

Angela Messioui & Jos Sanders, (forthcoming). "Economische kwalificatieveroudering en ontwikkelmogelijkheden in het werk: de rol van psychologische hulpbronnen en leeftijd", *Gedrag & Organisatie*.

2.1 Introduction

Technological and organisational developments follow one another at a rapid pace. These developments shorten the lifespan of employees' knowledge and skills across a wide range of sectors (Van Dam & Geuskens, 2019). In domains such as finance, engineering, and information and communication technology, changes in work processes and required skills occur continuously (Cedefop, 2018; McGuinness et al., 2021; Sanders & Kraan, 2013). In the telecommunications sector, which forms the context of this study, work has changed substantially because of digitalisation and innovations such as customer tracking systems, speech recognition, and omnichannel integration (Asimakopoulos & Whalley, 2017; Liébana-Cabanillas & Blanco-Encomienda, 2024).

When employees perceive that their existing knowledge and skills have lost value due to changing job requirements or labour market demands, they perceive economic skills obsolescence (Van Loo et al., 2001; De Grip & Van Loo, 2002; Sanders & Kraan, 2013). Previous research indicates that economic skills obsolescence is related to lower motivation, reduced job performance, diminished sustainable employability, and higher sickness absence (Jones et al., 2004; Sanders & Kraan, 2013; and see Chapter 3 and 4). In addition, economic skills obsolescence has been associated with feelings of stagnation, job insecurity, and reduced engagement in learning activities (Allen & De Grip, 2012; Sanders et al., 2015a; Sanders & Kraan, 2013; see Chapter 5). Because economic skills obsolescence is often driven by broader technological and organisational changes, continued development is essential for employees to remain aligned with changing job requirements.

In practice, however, stimulating development is complex. Employees differ in the extent to which they perceive opportunities to develop within their work. Earlier studies show that economic skills obsolescence is related to lower perceptions of development opportunities at work (see Chapter 4). This is particularly problematic because employees who are most affected by changing work demands may also be those who perceive fewer opportunities to develop. Whether employees continue to develop depends not only on contextual conditions but also on psychological resources that shape how development opportunities are recognised and utilised.

This chapter examines the role of three psychological resources that are relevant in the context of resource loss associated with economic skills obsolescence: learning attitude, learning efficacy, and mastery. These resources relate to employees' willingness and perceived ability to engage in learning and de-

velopment. In line with Conservation of Resources theory (Hobfoll, 1989, 2001), economic skills obsolescence is conceptualised as a loss of the resource of up-to-date knowledge and skills, which may place pressure on these psychological resources and, in turn, relate to lower perceptions of development opportunities at work.

In addition, age is considered a factor that may shape how employees respond to economic skills obsolescence. Previous research shows that work motives, learning orientations, and responses to changing work demands differ across the life course (Kanfer & Ackerman, 2004; Kooij et al., 2011; Kooij, 2024). Older employees who perceive economic skills obsolescence more often report motivational and health-related challenges (see Chapter 3), which may constrain their learning behaviour. To account for these differences, age is examined as a moderator in the relationships between economic skills obsolescence and the three psychological resources.

By integrating insights from Conservation of Resources theory (Hobfoll, 1989, 2001), Social Learning Theory (Bandura, 1986, 1997), and Selection, Optimisation, and Compensation theory (Baltes & Baltes, 1990), this chapter aims to clarify how economic skills obsolescence is related to perceptions of development opportunities at work and how psychological resources and age shape this relationship. In doing so, it contributes to a more nuanced understanding of development in the context of ongoing changes in work.

2.2 Theoretical background and hypotheses

2.2.1 Economic skills obsolescence and development opportunities at work

While some studies suggest that a lack of development opportunities may contribute to the perception of economic skills obsolescence (Sanders & Kraan, 2013), economic skills obsolescence is not approached here as an outcome. Instead, it is conceptualised as a predictor of employees' perceptions of development opportunities at work. This conceptualisation aligns with Conservation of Resources (COR) theory, which posits that individuals strive to retain, protect, and, where possible, build valued resources such as knowledge and skills, time, and energy (Hobfoll, 1989, 2001). Psychological strain arises when these resources are threatened or at risk of being lost.

Development opportunities at work are defined as employees' perceptions of the extent to which their current job offers opportunities to learn, develop new skills, realise ambitions, and make use of their talents (Van der Heijden et al., 2015). These opportunities primarily reflect the learning potential embedded in everyday work tasks and responsibilities, rather than formal training alone, and capture the extent to which employees perceive their job provides opportunities for ongoing development. The focus is therefore on perceived rather than objective opportunities, as perceptions determine whether development is perceived as accessible and worthwhile in the context of changing work demands.

Resource loss becomes more salient when opportunities to replenish resources are perceived as limited (Hobfoll, 1989, 2001). With increasing age, the perceived costs of investing in new resources may rise, while the anticipated returns of such investments may become more uncertain (Hobfoll & Wells, 1998). Such resource loss constitutes a psychologically meaningful stressor and may give rise to two broad behavioural orientations. On the one hand, individuals may engage in recovery-oriented behaviour aimed at restoring resources. On the other hand, they may adopt conservation-oriented behaviour focused on preventing further loss and limiting resource expenditure. Importantly, situations in which investment in new resources is most needed, such as when skills are perceived as outdated, may simultaneously undermine the capacity to invest. Hobfoll (2001) refers to this tension as the resource investment dilemma: restoring resources requires resource investment.

When conservation-oriented responses dominate, employees may become more cautious in how they allocate their remaining resources. Rather than directing effort and energy towards additional demands, they may focus on maintaining existing functioning and avoiding further depletion (Hobfoll, 2001). In this context, development opportunities may be perceived as less feasible or less accessible, even when such opportunities are formally available within the job.

Economic skills obsolescence can psychologically be perceived as a form of resource loss and is negatively related to perceived development opportunities at work (see Chapter 4). Employees who perceive economic skills obsolescence may therefore be less likely to perceive their work environment as offering room for further development.

This leads to the following hypothesis:

Hypothesis 1: Economic skills obsolescence is negatively related to development opportunities at work.

2.2.2 Psychological resources as mediators

In addition to a direct association, the relationship between economic skills obsolescence and perceived development opportunities at work may be partly explained by psychological resources that shape how employees respond to changing job requirements and the perceived depreciation of their skills. Psychological resources influence whether employees remain willing and able to engage in learning and development when their existing knowledge and skills are perceived as outdated. In this chapter, three psychological resources are examined: learning attitude, learning efficacy, and mastery. These resources reflect distinct but related aspects of how employees regulate learning and development under conditions of perceived resource loss.

Within COR theory, economic skills obsolescence can be conceptualised as a loss of the resource of up-to-date knowledge and skills (Hobfoll, 1989, 2001). Such resource loss is psychologically salient and may place pressure on other available resources. When employees perceive their skills as outdated, this may undermine learning-related psychological resources, thereby shaping how development opportunities at work are perceived. In this way, learning attitude, learning efficacy, and mastery may function as mediating mechanisms in the relationship between economic skills obsolescence and perceived development opportunities at work.

Learning attitude

Learning attitude refers to employees' general orientation towards learning, including beliefs about learning and motivation to engage in development activities (Van Dam, 2004). A positive learning attitude is associated with openness to learning and persistence, whereas a negative learning attitude is characterised by reluctance and avoidance of learning-related activities (Maurer et al., 2003; Sanders et al., 2015b).

Economic skills obsolescence may undermine learning attitude because it confronts employees with the perception that their existing knowledge and skills are no longer sufficient. When skills are perceived as outdated, employees may question the value or feasibility of further learning investments, particularly when previous learning experiences have been negative or uncertain. As a result, economic skills obsolescence is expected to be negatively related to learning attitude.

Learning attitude is relevant for how employees perceive development opportunities at work. Employees with a more positive learning attitude are more inclined to notice and utilise opportunities to develop, whereas employees with a more negative learning attitude may overlook or avoid such opportunities (Van Dam, 2004; Van der Heijden et al., 2016).

This leads to the following hypotheses:

Hypothesis 2a: Economic skills obsolescence is negatively related to learning attitude.

Hypothesis 2b: Learning attitude is positively related to development opportunities at work.

Hypothesis 2c: Learning attitude mediates the relationship between economic skills obsolescence and development opportunities at work.

Learning efficacy

Learning efficacy refers to employees' confidence in their ability to learn and acquire new skills. It is conceptually grounded in Social Learning Theory and closely related to efficacy beliefs concerning learning and development (Bandura, 1986, 1997). Learning efficacy reflects perceived capability rather than motivation and is therefore distinct from learning attitude.

Economic skills obsolescence may place pressure on learning efficacy by signalling to employees that their current skills have lost value due to changing job requirements. When employees perceive that their skills have become outdated, confidence in their ability to successfully engage in learning may decline, particularly when learning involves formal training or high-performance expectations (Maurer et al., 2003). Economic skills obsolescence is therefore expected to be negatively related to learning efficacy.

Learning efficacy is relevant for how employees perceive development opportunities at work. Employees who have greater confidence in their learning ability are generally more willing to approach learning challenges and to persist when difficulties arise, whereas lower learning efficacy may constrain engagement due to anticipated difficulties or fear of failure (Bandura, 1997; Van der Heijden et al., 2016). Learning efficacy thus represents a psychological mechanism through which economic skills obsolescence may be related to perceived development opportunities at work.

Accordingly, the following hypotheses are formulated:

Hypothesis 3a: Economic skills obsolescence is negatively related to learning efficacy.

Hypothesis 3b: Learning efficacy is positively related to development opportunities at work.

Hypothesis 3c: Learning efficacy mediates the relationship between economic skills obsolescence and development opportunities at work.

Mastery

Mastery refers to a general sense of control over one's life and functioning, including the extent to which individuals feel capable of influencing outcomes and coping with challenges (Pearlin et al., 1981). In a work context, mastery reflects a broader perception of control that extends beyond learning-specific beliefs or motivation. Economic skills obsolescence may undermine mastery by reducing predictability and perceived control over work functioning. When employees perceive that their skills have lost value in relation to changing job requirements, they may feel less able to manage their work effectively, thereby reducing their overall sense of control (Pearlin et al., 2007). Economic skills obsolescence is therefore expected to be negatively related to mastery.

Mastery is relevant for how employees perceive development opportunities at work. Employees who perceive a stronger sense of control are more likely to view development demands as manageable and worthwhile, whereas employees with lower mastery may be more inclined to disengage from additional demands or challenges (Pearlin et al., 2007). Mastery therefore constitutes a distinct psychological mechanism through which economic skills obsolescence may be related to perceived development opportunities at work.

This leads to the following hypotheses:

Hypothesis 4a: Economic skills obsolescence is negatively related to mastery.

Hypothesis 4b: Mastery is positively related to perceived development opportunities at work.

Hypothesis 4c: Mastery mediates the relationship between economic skills obsolescence and perceived development opportunities at work.

2.2.3 Age as a moderating factor

Responses to economic skills obsolescence may differ across the life course. Prior research indicates that age is associated with differences in work motives, learning orientations, and responses to changing work demands. As employees grow older, perceived recovery opportunities tend to decline, and greater value is often placed on preserving existing resources rather than investing in new ones (Kanfer & Ackerman, 2004; Kooij et al., 2011; Kooij, 2024).

Resource loss becomes more salient when opportunities to replenish resources are perceived as limited (Hobfoll, 1989, 2001). With increasing age, the perceived costs of investing in new resources may rise, while the anticipated returns of such investments may become more uncertain (Hobfoll & Wells, 1998). Under these conditions, economic skills obsolescence may exert stronger pressure on employees' psychological resources among older employees than among younger employees.

Selection, Optimisation, and Compensation theory (Baltes & Baltes, 1990) provides additional insight into these age-related differences. According to this framework, individuals adapt their goals and behaviour in response to declining resources through strategies of selection, optimisation, and compensation (Baltes & Baltes, 1990). Older employees are more likely to prioritise maintaining or compensating existing strengths, whereas younger employees tend to invest more readily in acquiring new knowledge and skills. These differences suggest that economic skills obsolescence may be more strongly associated with changes in learning-related psychological resources at higher ages.

In addition, Social Learning Theory (Bandura, 1986) highlights the role of learning-related self-beliefs in shaping responses to learning demands. Older employees report, on average, lower confidence in their learning ability and may perceive learning as more demanding, which can render learning-related resources more vulnerable when skills are perceived as outdated (Maurer et al., 2003; Sanders, 2016). These perspectives indicate that age may moderate the relationships between economic skills obsolescence and learning attitude, learning efficacy, and mastery, such that the negative relationships are expected to be stronger for older employees.

Moderation of the learning attitude pathway

Learning attitude reflects employees' general willingness to invest in learning and development. Older employees are more likely to prioritise the preservation

of remaining resources and to avoid investments that are perceived as costly or uncertain (Hobfoll, 2001). As opportunities to replenish resources are often perceived as more limited at higher ages, signals of economic skills obsolescence may more strongly undermine older employees' learning attitude than that of younger employees. Accordingly, the negative relationship between economic skills obsolescence and learning attitude is expected to be stronger among older employees than among younger employees.

This leads to the following hypothesis:

Hypothesis 5: Age moderates the relationship between economic skills obsolescence and learning attitude, such that this negative relationship is stronger for older employees.

Moderation of the learning efficacy pathway

Learning efficacy reflects employees' confidence in their ability to successfully engage in learning. Older employees tend to perceive learning as more effortful and report lower confidence in their learning abilities, particularly in demanding or formal learning contexts (Maurer et al., 2003; Sanders, 2016). In addition, recovery from unsuccessful learning experiences may be perceived as more limited at higher ages. As a result, signals of economic skills obsolescence may more strongly undermine learning efficacy among older employees than among younger employees. Accordingly, the negative relationship between economic skills obsolescence and learning efficacy is expected to be stronger at higher ages.

This leads to the following hypothesis:

Hypothesis 6: Age moderates the relationship between economic skills obsolescence and learning efficacy, such that this negative relationship is stronger for older employees.

Moderation of the mastery pathway

Mastery reflects a general sense of control over one's life and functioning, including the perceived ability to influence outcomes and cope with challenges (Pearlin et al., 1981). Economic skills obsolescence may undermine mastery by reducing predictability and perceived control over work functioning (Pearlin et al., 2007), particularly when employees perceive that their skills have lost value in relation to changing job requirements.

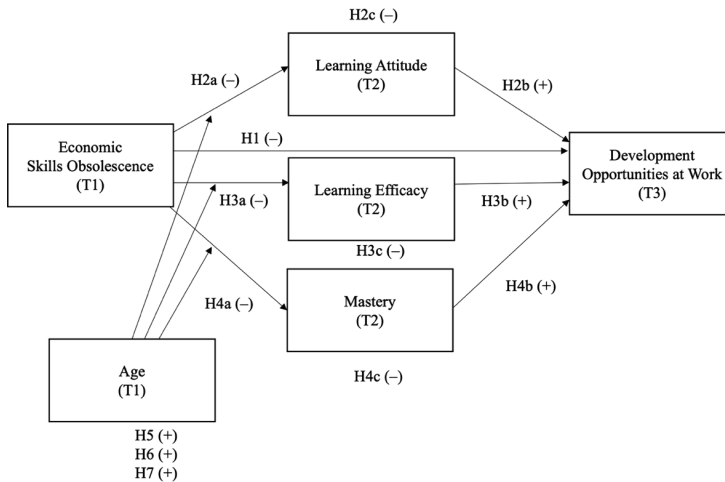
As employees grow older, opportunities to restore lost resources are often perceived as more limited, while maintaining existing functioning becomes increasingly salient (Hobfoll & Wells, 1998). In line with Selection, Optimisation, and Compensation theory, older employees may rely more strongly on existing resources to preserve control, which may render mastery more vulnerable when economic skills obsolescence is perceived (Baltes & Baltes, 1990). Accordingly, the negative relationship between economic skills obsolescence and mastery is expected to be stronger among older employees than among younger employees.

This leads to the following hypothesis:

Hypothesis 7: Age moderates the relationship between economic skills obsolescence and mastery, such that this negative relationship is stronger for older employees.

Figure 2.1 shows the hypothesised model of the relationship between economic skills obsolescence and development opportunities at work.

Figure 2.1 Hypothesised model of economic skills obsolescence and development opportunities at work.



Notes. T= time. H = hypothesis; the direction of the relationship is indicated in parentheses as (+) or (-).

2.3 Method

2.3.1 Sample and data collection

This study uses longitudinal survey data collected among employees of a Dutch telecommunications organisation. Data were collected at three measurement waves, each separated by a six-month interval, over a one-year period (from September 2021 to September 2022). At each measurement wave, participants received an email invitation containing a link to an online questionnaire administered via Qualtrics. Prior to participation, all respondents provided informed consent. They were informed about the purpose, content, and confidentiality of the study, and that their anonymity was guaranteed.

The first measurement (Time 1; T1) was completed by 1,444 employees (response rate 52%). The second measurement (Time 2; T2), conducted six months later, was completed by 750 employees (response rate 27%), and the third measurement (Time 3; T3) by 665 employees (response rate 24%). For the analyses, only employees who participated in all three measurement waves were included ($N = 490$).

To assess selective attrition, respondents who completed all measurement waves were compared with those who dropped out prematurely (0 = no attrition, 1 = attrition). Attrition analyses showed that employees who dropped out after T1 or T2 differed significantly from those who participated in all three waves in terms of age and perceived development opportunities, with younger employees ($B = -1.00, p < .001$) and those reporting lower development opportunities ($B = -.26, p = .003$) being more likely to drop out. Although these differences were statistically significant, effect sizes were small to moderate, suggesting that attrition may have reduced variability in perceived development opportunities but is unlikely to have fully driven the observed associations.

The final sample is representative of the different occupational groups within the organisation and shows a balanced age distribution. Respondents' ages ranged from 19 to 66 years ($M = 45.47, SD = 10.24$). Participants worked as call centre employees (49.2%), technicians (23.9%), managers (10.6%), staff employees (e.g., HR, assistants) (9.8%), or in other roles (e.g., engineers and project managers) (6.5%).

2.3.2 Measures

Economic skills obsolescence was measured using five items derived from Sanders and Kraan (2013). Respondents indicated the extent to which their knowledge and skills had become less relevant as a result of technological and organisational changes. Items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores indicated a higher level of perceived economic skills obsolescence. (Cronbach's $\alpha = .80$). The five items were:

- Tasks I am good at are becoming less important.
- Technological developments make much of my knowledge and skills outdated.
- Much of my knowledge and skills are no longer valued by the organisation.
- My type of work is becoming less common in organisations.
- I lack 'new' knowledge and skills that have become important due to changes in my work.

Development opportunities at work were measured with four items from Van der Heijden et al. (2015). Respondents indicated the extent to which they perceived opportunities for development within their job. Items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Higher scores reflected more perceived development opportunities at work. (Cronbach's $\alpha = .91$). The four items were:

- In my current job, I can fulfil my ambitions.
- I can develop myself sufficiently in my job.
- My work offers me the opportunity to learn new things.
- At my organisation they make good use of the talents that I possess.

Learning attitude was measured using four items from the 'Werken en Leren' questionnaire developed by TNO (2008). Respondents rated their attitude towards participating in training or education on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Higher scores indicated a more positive learning attitude (Cronbach's $\alpha = .84$). The four items were:

- Participating in training or education is enjoyable.
- Participating in training or education is a punishment (reverse-coded).
- Participating in training or education is important.
- Participating in training or education is something to be proud of.

Learning efficacy was measured using five items from the Work Skills questionnaire developed by Hazelzet et al. (2011), assessing employees' confidence in their own learning ability. Items were rated on a five-point Likert scale (1 =

strongly disagree, 5 = strongly agree). Higher scores indicated higher learning efficacy (Cronbach's $\alpha = .91$). The five items were:

- I am confident that I will be a good trainee or student.
- I am confident that I can successfully complete the assignments of a training or course.
- I am confident that I can cope with a training or course.
- I am confident that I can persist in a training or course, even when it is difficult.
- I am confident that I can solve potential problems during a training or course.

Mastery was measured using a shortened version of the Pearlin Mastery Scale (Pearlin et al., 1981), consisting of five items. All items were negatively phrased and rated on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). For the analyses, all items were reverse-coded so that higher scores reflected a stronger sense of mastery, consistent with the direction of the other psychological resources (Cronbach's $\alpha = .84$). The five items were:

- I have little control over the things that happen to me.
- I really cannot solve some of the problems I have.
- There is little I can do to change important things in my life.
- I often feel helpless in dealing with the problems of life.
- Sometimes I feel pushed around in life.

Control variables included age, educational level and tenure. Age was included as a continuous variable and modelled both as a moderator on the a-path (economic skills obsolescence $\times$ age) and as a control variable. Age was mean-centred prior to computing the interaction terms, allowing the moderation effects to be estimated while accounting for average age differences. Other control variables included educational level and organisational tenure. Educational level was coded as 0 = lower/ middle educated (maximum mbo-4) and 1 = higher educated (hbo or university), and tenure was included as a continuous variable.

2.3.3 Statistical analysis

Hypotheses were tested in two steps using SPSS 27 and the PROCESS macro (Hayes, 2017). First, a parallel mediation model without interaction terms was estimated (PROCESS Model 4) to test the direct relationship between economic skills obsolescence and perceived development opportunities at work (Hypothesis 1), as well as the indirect relationships via learning attitude, learning efficacy, and mastery (Hypotheses 2a–2c, 3a–3c, and 4a–4c). All three mediators were included simultaneously, allowing the unique contribution of each mediating pathway to be assessed. Second, a moderated mediation model was estimated (PROCESS Model 7), in which age moderated only the relationships between

economic skills obsolescence and the psychological resources learning attitude, learning efficacy, and mastery. This model was used to test the age-related moderation hypotheses concerning the a-paths (Hypotheses 5 through 7).

The study employed a time-lagged design, with the predictor (economic skills obsolescence) and the moderator (age) measured at T1, the mediators measured at T2, and the outcome variable (perceived development opportunities at work) measured at T3, with six months between each measurement wave. This design supports the temporal ordering of the hypothesised relationships. Missing values were handled using listwise deletion, such that only respondents with complete data across all three measurement waves were included in the analyses. Educational level, age, and organisational tenure were included as control variables in all analyses. Statistical significance was evaluated at $p < .05$. Indirect associations were assessed using 95% confidence intervals based on bootstrap analyses with 5,000 samples; indirect effects whose confidence intervals did not include zero were interpreted as statistically significant. Conditional estimates for the moderation analyses were calculated at one standard deviation below and above the mean level of age. Unstandardised regression coefficients (B) are reported.

2.4 Results

2.4.1 Descriptive statistics and Pearson correlations

Table 2.1 presents the descriptive statistics and Pearson correlations among the study variables. Economic skills obsolescence is negatively correlated with perceived development opportunities at work ($r = -.27, p < .01$), learning attitude ($r = -.24, p < .01$), learning efficacy ($r = -.26, p < .01$), and mastery ($r = -.36, p < .01$). The three psychological resources are positively correlated (r ranging from .35 to .41, $p < .01$) and are also positively related to perceived development opportunities at work (learning attitude: $r = .31$; learning efficacy: $r = .30$; mastery: $r = .39$; $p < .01$).

Age is positively correlated with economic skills obsolescence ($r = .09, p < .05$) and mastery ($r = .12, p < .05$), and negatively correlated with learning attitude ($r = -.16, p < .01$) and learning efficacy ($r = -.13, p < .01$). Educational level is positively correlated with learning efficacy ($r = .18, p < .01$) and mastery ($r = .14, p < .05$), and negatively correlated with development opportunities at work ($r = -.14, p < .05$). Organisational tenure is correlated with age ($r = .51, p < .01$), but not with the core study variables.

Table 2.1 Descriptive statistics and Pearson correlations

	M	SD	1	2	3	4	5	6	7
1. Economic skills obsolescence	2.31	0.73							
2. Learning attitude	4.00	0.67	-.24**						
3. Learning efficacy	4.07	0.63	-.26**	.35**					
4. Mastery	3.76	0.73	-.36**	.41**	.38**				
5. Development opportunities	3.67	0.97	-.27**	.31**	.30**	.39**			
6. Age	45.47	10.24	.09*	-.16**	-.13**	.12*	.07		
7. Education ^a	1.31	0.46	.11*	.07	.18**	.14*	-.14*	-.04	
8. Tenure	13.7	8.59	.07	.06	.10*	.10*	.09	.51**	.10*

Notes. (n = 481). * $p < .05$. ** $p < .01$. ^aEducation is coded as 1 higher; 0 middle/ lower.

M = mean. SD = standard deviation.

2.4.2 Parallel mediation analysis

The results of the parallel mediation analysis are presented in Table 2.2. The model explains 15% of the variance in perceived development opportunities at work ($R^2 = .15$, $F(7, 473) = 12.23$, $p < .001$). None of the control variables (age, education, and tenure) show significant relationships with development opportunities at work.

Hypothesis 1 proposes that economic skills obsolescence is negatively related to perceived development opportunities at work. The results show a significant negative relationship ($B = -.46$, $SE = .06$, $p < .001$, 95% $CI [-.58, -.34]$), supporting Hypothesis 1.

When the three psychological resources are included in the model, the direct relationship between economic skills obsolescence and development opportunities at work remains significant ($B = -.38$, $SE = .07$, $p < .001$, 95% $CI [-.51, -.25]$). This indicates that the relationship between economic skills obsolescence and perceived development opportunities at work is only partially explained by the mediators.

Hypothesis 2a proposes that economic skills obsolescence is negatively related to learning attitude. This hypothesis is supported ($B = -.22$, $SE = .04$, $p < .001$). **Hypothesis 2b** proposes that learning attitude is positively related to perceived development opportunities at work. This hypothesis is supported ($B = .16$, $SE = .08$, $p = .03$). **Hypothesis 2c** proposes that learning attitude mediates the relationship between economic skills obsolescence and perceived development opportunities at work. The indirect relationship via learning attitude is significant and negative ($B = -.04$, $SE = .02$, 95% $CI [-.07, -.004]$), supporting Hypothesis 2c.

Hypothesis 3a predicts that economic skills obsolescence is negatively related to learning efficacy. This hypothesis is supported ($B = -.22$, $SE = .04$, $p < .001$). **Hypothesis 3b** proposes that learning efficacy is positively related to perceived development opportunities at work. This hypothesis is not supported, as the relationship is negative ($B = -.20$, $SE = .08$, $p < .01$). **Hypothesis 3c** proposes that learning efficacy mediates the relationship between economic skills obsolescence and perceived development opportunities at work. The indirect relationship via learning efficacy is significant but positive ($B = .04$, $SE = .02$, 95% CI [.01, .08]), which is opposite to the hypothesised direction of the indirect pathway.

Hypothesis 4a proposes that economic skills obsolescence is negatively related to mastery. This hypothesis is supported ($B = -.35$, $SE = .05$, $p < .001$). **Hypothesis 4b** proposes that mastery is positively related to perceived development opportunities at work. This hypothesis is supported ($B = .25$, $SE = .06$, $p < .001$). **Hypothesis 4c** proposes that mastery mediates the relationship between economic skills obsolescence and perceived development opportunities at work. The indirect relationship via mastery is significant and negative ($B = -.09$, $SE = .03$, 95% CI [-.14, -.04]), supporting Hypothesis 4c.

Table 2.2 Direct and indirect relationships between economic skills obsolescence and development opportunities at work

	B	SE	95% CI
Economic skills obsolescence (ESO) → resources			
Learning attitude	-.22***	.04	[-.31, -.14]
Learning efficacy	-.22***	.04	[-.30, -.14]
Mastery	-.35***	.05	[-.44, -.26]
Resources → development opportunities at work			
Learning attitude	.16*	.08	[.02, .31]
Learning efficacy	-.20**	.08	[-.36, -.04]
Mastery	.25***	.06	[.13, .37]
(In)direct relationships ESO → development opportunities at work			
	B	SE	95% CI
Total	-.46***	.06	[-.58, -.34]
Direct	-.38***	.07	[-.51, -.25]
Total indirect	-.08**	.03	[-.14, -.02]
Indirect via learning attitude	-.04*	.02	[-.07, -.004]
Indirect via learning efficacy	.04*	.02	[.01, .08]
Indirect via mastery	-.09**	.03	[-.14, -.04]

Notes. ($n = 481$). * $p < .05$. ** $p < .01$. *** $p < .001$. ESO = economic skills obsolescence. Unstandardised coefficients are reported with two decimals; standard errors (SE) smaller than .01 are reported with three decimals. 95% bootstrap confidence intervals are based on 5,000 resamples. Confidence intervals (CI's) that do not include zero indicate statistically significant effects.

2.4.3 Age-moderated mediation analysis

The results of the moderated mediation analyses are presented in Table 2.3. The model explains 13% of the variance in perceived development opportunities at work ($R^2 = .13$, $F(4, 476) = 17.22$, $p < .001$). Figure 2.2 and 2.3 display the interactions of $ESO \times age$.

Hypothesis 5 proposes that age moderates the relationship between economic skills obsolescence and learning attitude. This hypothesis is supported, as the interaction between economic skills obsolescence and age is significant ($B = -.01$, $SE = .004$, $p < .01$). Conditional effects indicate that the negative association between economic skills obsolescence and learning attitude increases with age: for younger employees ($-1 SD$; $B = -.09$, $SE = .05$, $p = .04$), for employees of average age ($B = -.21$, $SE = .04$, $p < .001$), and for older employees ($+1 SD$; $B = -.33$, $SE = .05$, $p < .001$). Consistent with this pattern, the conditional indirect association between economic skills obsolescence and perceived development opportunities at work via learning attitude is significant at higher ages ($+1 SD$; $B = -.05$, 95% $CI [-.09, -.01]$), but not at lower ages ($-1 SD$; $B = -.01$, 95% $CI [-.05, .02]$).

Hypothesis 6 proposes that age moderates the relationship between economic skills obsolescence and learning efficacy. This hypothesis is supported, as the interaction between economic skills obsolescence and age is significant ($B = -.01$, $SE = .004$, $p < .05$). Conditional effects show a consistent increase in strength across age groups: for younger employees ($-1 SD$; $B = -.13$, $SE = .04$, $p = .002$), for employees of average age ($B = -.24$, $SE = .04$, $p < .001$), and for older employees ($+1 SD$; $B = -.35$, $SE = .05$, $p < .001$). The conditional indirect effect via learning efficacy differs across age levels. At higher ages ($+1 SD$), the indirect effect is statistically significant ($B = .08$, 95% $CI [.03, .12]$), whereas this is not significant at lower ages ($-1 SD$; $B = .02$, 95% $CI [-.02, .06]$).

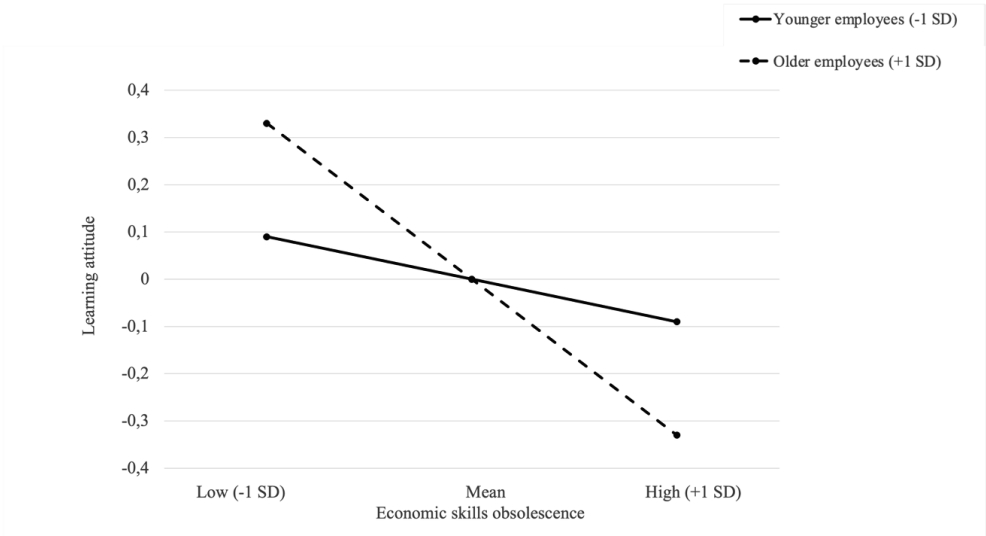
Hypothesis 7 predicts that age moderates the relationship between economic skills obsolescence and mastery. This hypothesis is not supported, as the interaction between economic skills obsolescence and age is not significant ($B = -.00$, $SE = .004$, $p = .56$). Accordingly, the indirect association between economic skills obsolescence and perceived development opportunities at work via mastery does not differ across age levels.

Table 2.3 Age as a moderator on the relationship between economic skills obsolescence and the psychological resources: learning attitude, learning efficacy and mastery

	B	SE	95% CI
Learning attitude			
Economic skills obsolescence	-.21***	.04	[-.29, -.13]
Age	-.01***	.003	[-.02, -.005]
ESO × age	-.01**	.004	[-.02, -.004]
Learning efficacy			
Economic skills obsolescence	-.24***	.04	[-.31, -.16]
Age	-.01**	.003	[-.01, -.003]
ESO × age	-.01*	.004	[-.02, -.001]
Mastery			
Economic skills obsolescence	-.38***	.04	[-.47, -.29]
Age	.01*	.003	[.00, .01]
ESO × age	-.00	.004	[-.01, .01]
(In)direct relationships ESO → development opportunities at work			
	B	SE	95% CI
Economic skills obsolescence	-.31***	.06	[-.44, -.19]
Learning attitude	.16*	.08	[.01, .31]
Learning efficacy	-.25**	.08	[-.42, -.09]
Mastery	.22***	.06	[.10, .34]

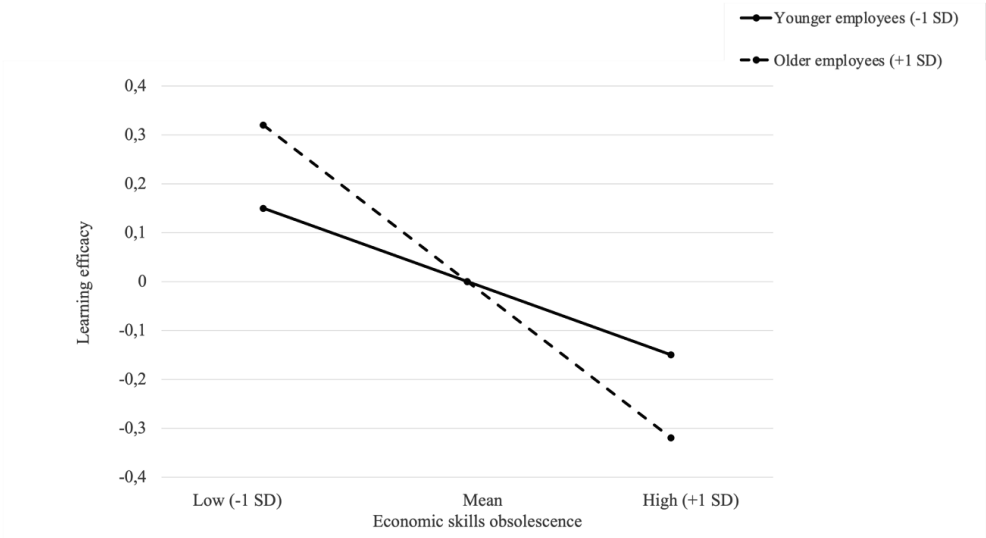
Notes. (n = 481). * $p < .05$. ** $p < .01$. *** $p < .001$. ESO = economic skills obsolescence. Un-standardised coefficients are reported with two decimals; standard errors (SE) smaller than .01 are reported with three decimals. 95% bootstrap confidence intervals are based on 5,000 resamples. Confidence intervals that do not include zero indicate statistically significant effects.

Figure 2.2 Interaction between economic skills obsolescence and age on learning attitude



Notes. Lines represent predicted values based on unstandardised regression coefficients. Age is plotted at -1 SD (younger employees) and +1 SD (older employees). Economic skills obsolescence is plotted at -1 SD, mean, and +1 SD. Continuous variables are mean-centred prior to analysis.

Figure 2.3 Interaction between economic skills obsolescence and age on learning efficacy



Notes. Lines represent predicted values based on unstandardised regression coefficients. Age is plotted at -1 SD (younger employees) and +1 SD (older employees). Economic skills obsolescence is plotted at -1 SD, mean, and +1 SD. Continuous variables are mean-centred prior to analysis.

2.5 Discussion

This study examines how economic skills obsolescence is related to perceived development opportunities at work and whether this relationship can be understood through psychological resources. Using a longitudinal design, the findings show that economic skills obsolescence is negatively related to development opportunities at work. This relationship is partly explained by learning attitude, learning efficacy, and mastery. In addition, age moderates the relationships between economic skills obsolescence and learning attitude as well as learning efficacy, whereas no age-related moderation is observed for mastery.

The findings indicate that employees who perceive higher levels of economic skills obsolescence report fewer perceived development opportunities at work. This finding supports the notion that changes in job requirements are not only relevant in terms of objective skill requirements but also shape how employees perceive opportunities for their development. Economic skills obsolescence can be understood as a psychologically form of resource loss, in line with Conservation of Resources theory (Hobfoll, 1989). When employees perceive that their existing knowledge and skills lost their value in relation to changing job requirements, this perception signals a loss of valued resources, which subsequently undermines learning-related psychological resources and shapes how development opportunities are evaluated, even when such opportunities are formally available.

Moreover, the direct relationship between economic skills obsolescence and development opportunities at work remains significant when psychological resources are taken into account. This indicates that, in addition to psychological mechanisms, other processes contribute to how economic skills obsolescence shapes perceptions of development opportunities at work. These may include organisational practices, job design characteristics, or structural conditions that influence access to learning and development (Sanders & Kraan, 2013; Van der Heijden et al., 2015).

The results show that psychological resources play a meaningful role in explaining how economic skills obsolescence is related to perceived development opportunities at work, although the nature of these pathways differs across resources. Learning attitude partially explains the relationship between economic skills obsolescence and perceived development opportunities. Employees who perceive their skills as outdated report a less positive orientation towards learning, which in turn is associated with fewer perceived opportunities to develop. This pattern is consistent with earlier research indicating that negative learning

experiences and reduced learning motivation can constrain engagement in development activities (Maurer et al., 2003; Van Dam, 2004; Sanders et al., 2015a).

Learning efficacy shows a more complex pattern. Although economic skills obsolescence is negatively related to learning efficacy, learning efficacy has a negative unique association with perceived development opportunities at work when learning attitude and mastery are included simultaneously in the model. As a result, the indirect relationship via learning efficacy is positive and opposite to the hypothesised direction. This unexpected direction should be interpreted considering the parallel mediation model, in which learning efficacy is estimated while controlling for learning attitude and mastery. In the bivariate correlations, learning efficacy is positively associated with development opportunities at work, whereas the negative coefficient in the mediation model reflects the unique association of learning efficacy after accounting for the shared variance with the other psychological resources. One possible explanation is that the scale used primarily captures confidence in formal learning contexts, whereas the outcome measure also includes informal development opportunities embedded in daily work. This difference in operationalisation may result in divergent associations when formal learning confidence does not directly translate into perceiving informal development opportunities.

This distinction between formal and informal learning is important for interpreting the unexpected direction of the indirect effect. Confidence in formal learning may not translate directly into perceiving informal development opportunities as accessible, particularly when such opportunities depend on contextual support and task-level autonomy rather than structured training. In addition, employees with higher learning efficacy may evaluate development opportunities more critically or hold higher expectations regarding their quality, which may result in lower perceived availability when such expectations are not met.

Mastery emerges as a particularly relevant psychological resource. Economic skills obsolescence is strongly related to lower mastery, and mastery is positively related to perceived development opportunities at work. This pathway explains a substantial part of the relationship between economic skills obsolescence and development opportunities. A lower sense of mastery may reduce employees' confidence in their ability to benefit from development opportunities, making such opportunities seem less accessible or manageable.

Age moderates the relationships between economic skills obsolescence and both learning attitude and learning efficacy. The negative associations between economic skills obsolescence and these learning-related psychological re-

sources are stronger among older employees than among younger employees, indicating that the perception of economic skills obsolescence more strongly undermines learning-related resources at higher ages. In particular, the indirect relationship between economic skills obsolescence and perceived development opportunities via learning attitude is evident primarily among older employees, indicating that this pathway is especially salient at later career stages.

This pattern is consistent with age-related differences in learning experiences, perceived costs of investing in development, and perceived resource availability (Kanfer & Ackerman, 2004; Kooij et al., 2011; Hobfoll & Wells, 1998). These findings are also consistent with Selection, Optimisation, and Compensation theory (Baltes & Baltes, 1990), which suggests that older employees may respond to perceived resource loss by becoming more selective in their investment of learning-related resources.

However, the findings indicate that age-related vulnerability operates primarily between economic skills obsolescence and learning attitude and learning efficacy. Although economic skills obsolescence more strongly erodes learning attitude and learning efficacy among older employees, the downstream implications for perceived development opportunities differ across psychological resources. In particular, the indirect pathway via learning efficacy shows a more complex pattern, suggesting that reduced confidence in learning ability does not translate straightforwardly into lower perceptions of development opportunities. This underscores that age-related differences in responses to economic skills obsolescence are not uniform across mechanisms.

2.5.1 Theoretical implications

This study contributes to the literature on skills obsolescence by showing that economic skills obsolescence is not only related to labour market outcomes or health-related indicators, but also to employees' perceptions of development opportunities at work. By conceptualising economic skills obsolescence as the perceived depreciation of existing knowledge and skills and in relation to changing job requirements, the findings illustrate how changes in work translate into differences in learning-related motivation, confidence, and perceived mastery. The results further underline the relevance of psychological resources for understanding responses to skills obsolescence. Rather than assuming that development opportunities are equally accessible to all employees, this study shows that employees' psychological resources shape whether they perceive such opportunities as available within their job. Employees with lower learning attitude and mastery may be less likely to recognise and engage with opportu-

nities for development, even when such opportunities are objectively present.

2.5.2 Limitations and future research

This study has several limitations that should be considered when interpreting the findings. First, the study relies on self-reported data and a time-lagged design, with economic skills obsolescence measured at T1, the mediators at T2, and development opportunities at work at T3. Although the variables are measured across three time points, common method bias cannot be fully ruled out (Podsakoff et al., 2003). Future research may use experimental designs or more intensive longitudinal designs to provide stronger support for causal assumptions.

Second, the analyses include only respondents who participated in all three measurement waves. Although attrition analyses show only limited differences on the core study variables, selective dropout cannot be fully excluded, particularly among younger employees and those reporting lower development opportunities. In addition, the use of listwise deletion in the PROCESS macro implies that cases with missing data were excluded from the analyses. Future research may therefore benefit from applying Structural Equation Modelling with Full Information Maximum Likelihood to address missing data in a more advanced manner.

Third, the study faces a limitation regarding operationalisation. The scale used to assess learning efficacy primarily captures confidence in formal learning contexts, whereas development opportunities at work also include informal learning opportunities. Although prior studies show positive associations between formal learning efficacy and broader learning outcomes (Maurer et al., 2003; Van der Heijden et al., 2016), future research may benefit from a broader operationalisation of learning efficacy that distinguishes between formal and informal learning contexts.

Finally, future research is needed to examine the generalisability of these findings across other sectors and occupational groups. This may help to identify which groups of employees are most vulnerable to economic skills obsolescence and which psychological resources are most relevant for sustaining perceptions of development opportunities at work. Given the ongoing acceleration of technological change, this question becomes increasingly salient.

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Economic skills obsolescence and sickness absence among older employees

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3.1 Introduction

Driven by accelerated technological change, the labour market faces continuous shifts in the skills required to remain productive in a job (Acemoglu & Restrepo, 2019). Particularly for older employees who developed their skills earlier in their careers, often in relation to technologies that may now become outdated, this creates the risk of economic skills obsolescence and potential job loss. Such shifts in skill demand may constitute an important, yet underreported, source of work-related stress (Härmä & Kompier, 2006). In the European Union labour market, 29% of older employees expect several of their skills to become obsolete within the next five years (Cedefop, 2018). In addition, older employees are less likely to use advanced ICT skills within similar occupational groups and tend to adjust more slowly to changing labour market requirements (OECD, 2025). Lower average digital skill levels among older employees further increase their exposure to technological change (Cedefop, 2026).

The risk of skills obsolescence becomes even more consequential in the context of pension reforms that have extended working lives in many developed countries (Börsch-Supan & Coile, 2018). As statutory retirement ages increase, older employees must remain employable for longer periods. However, prior research shows that older employees may lose employability before reaching retirement eligibility due to skills obsolescence, deteriorating health, and age discrimination (Gommans et al., 2017). Together, these developments increase older employees' exposure to the threat and stress associated with economic skills obsolescence.

Human capital literature distinguishes between two types of skills obsolescence: technical and economic skills obsolescence (De Grip & Van Loo, 2002). Technical skills obsolescence refers to the decay or loss of skills due to physiological ageing, illness, injury, or prolonged non-use (Arthur & Day, 2020). Economic skills obsolescence, which is the focus of this chapter, does not concern the deterioration of existing skills but refers to employees' *perception* that their skills lose value because of changing job requirements (Allen & De Grip, 2012). As work environments evolve, previously adequate skills may become outdated, requiring updating or upgrading to maintain adequate job performance (McGuinness et al., 2023; Spitz-Oener, 2006). Technological innovation leads to the upgrading of job tasks and alters the skills required to perform work effectively (Neuman & Weiss, 1995; Spitz-Oener, 2006). As a result, employees may perceive a loss of value of previously sufficient skills in relation to changing job requirements, particularly when digital skills become more central to task performance (Allen & De Grip, 2012; McGuinness et al., 2021).

Employees may respond proactively to economic skills obsolescence by investing in learning and development (Allen & De Grip, 2012). However, older employees participate in job-related training substantially less often than younger employees (OECD, 2020). Several mechanisms contribute to this vulnerability. First, many older employees face barriers in bridging digital skill gaps because they began their careers before widespread computerisation (Hudomiet & Willis, 2022). Second, organisations and employees may hold negative stereotypes regarding older employees' productivity, resulting in "work-relief" policies, such as less demanding tasks or additional leave, rather than development opportunities and training (Van Dam et al., 2017). Third, limited participation in development activities reduces opportunities to adapt to changing job demands (Van Hootegeem et al., 2023). Together, these conditions increase older employees' susceptibility to the stress associated with economic skills obsolescence.

Previous research shows that economic skills obsolescence is associated with work-related stress. Employees may feel constant pressure to update their skills and fear a loss of employability (Tsai et al., 2007). Building on this literature, the main research question of this chapter is: Does economic skills obsolescence increase older employees' sickness absence? This question is particularly relevant because sickness absence is costly for organisations (Bakker et al., 2003; Kocakulah et al., 2016) and constitutes an important precursor of early labour market withdrawal. Gommans et al. (2017) found that older employees who perceive themselves as lacking the necessary skills to perform adequately in their job report greater depletion of mental and physical resources at the end of the working day, resulting in a higher need for recovery.

In line with occupational epidemiology, the term *sickness absence* refers to medically certified absence from work, whereas earlier human resource management research often used the broader concept of *absenteeism* (Johns & Miraglia, 2015; Henderson et al., 2012). Sickness absence literature distinguishes between absence duration and absence frequency (Darr & Johns, 2008; Van der Burg et al., 2020). Absence duration is commonly linked to health problems, whereas absence frequency more strongly reflects dissatisfaction or withdrawal from work. Building on Schaufeli et al. (2009) and Ten Brummelhuis et al. (2013), we expect that the distress associated with economic skills obsolescence affects both sickness absence frequency and average absence duration through burnout and work engagement.

Many studies have examined causes of sickness absence, including physical and mental workload, illness, and employee characteristics (Kocakulah et al., 2016). Other research highlights job-related factors such as job content, au-

tonomy, social relations, and occupational status (Leijten et al., 2013; Steensma, 2013). From a multidisciplinary perspective, this study is the first to investigate the threat and stress of economic skills obsolescence as a potential driver of sickness absence.

3.2 Theoretical background and hypotheses

To explain how economic skills obsolescence contributes to sickness absence, we draw on Conservation of Resources (COR) theory and the Job Demands–Resources (JD–R) framework. Both perspectives emphasise that employees need sufficient resources to sustain health and motivation. COR theory (Hobfoll, 2002) defines stress as a reaction to actual or threatened loss of valued resources, such as time, energy, or skills, or to the failure to gain new resources after substantial effort. Individuals strive to protect, retain, and build these resources, and prolonged exposure to resource loss initiates a *loss spiral* that undermines health and functioning (Hobfoll et al., 2018). JD–R theory (Bakker et al., 2003) extends this logic to the work context: every job includes specific demands that require sustained physical or mental effort and resources that enable employees to meet these demands. High job demands combined with a lack of resources create stress, whereas adequate resources foster motivation and engagement.

These theories describe two interrelated pathways through which work stressors affect well-being and behaviour. The health-impairment process of JD–R reflects COR’s principle of resource depletion: demanding conditions exhaust employees’ energy, leading to strain and, ultimately, health problems. The motivational process, in turn, explains how ample resources stimulate vigour and dedication. When resources are threatened or insufficient, this motivation declines, increasing the likelihood of withdrawal behaviours such as sickness absence (Schaufeli et al., 2009; Ten Brummelhuis et al., 2013). Integrating COR and JD–R therefore allows us to understand both the deterioration of health and the erosion of motivation caused by economic skills obsolescence. Within this framework, economic skills obsolescence functions as a specific job stressor that threatens employees’ psychological and instrumental resources. When technological and organisational changes alter skill requirements, employees may perceive that their existing skills no longer suffice to perform effectively (Allen & De Grip, 2012; Neuman & Weiss, 1995). The ongoing effort to maintain up-to-date skills, combined with concerns about maintaining adequate employability– creates a sense of diminished control and escalating job demands.

For older employees, these pressures are intensified by structural constraints such as outdated educational backgrounds, limited training access, and negative age stereotypes that reduce opportunities to regain resources (Hudomiet & Willis, 2022; Van Dam et al., 2017; Weiss et al., 2020). As a result, they may enter a cycle of increasing effort and decreasing resource replenishment, leading to either health impairment or motivational decline. Because COR and JD-R theory together suggest that sickness absence may function as a behavioural response to strain or reduced motivation, the association between economic skills obsolescence and sickness absence is expected to operate only indirectly through burnout and work engagement. Both processes are expected to manifest in higher sickness absence rates.

3.2.1 Dual outcomes and cross-pathways

Sickness absence can be represented by two related but distinct indicators: duration, the total number of days absent, and frequency, the number of separate absence spells. Traditionally, duration has been associated with health-related incapacity (involuntary absence), while frequency reflects behavioural withdrawal or motivational factors (voluntary absence) (Darr & Johns, 2008; Kivimäki et al., 2003; Steel, 2003). However, empirical research has questioned this strict division, showing that both measures often share common antecedents such as burnout and engagement (Johns & Al Hajj, 2016; Ten Brummelhuis et al., 2013). Following this evidence, we include both absence measures to capture the full behavioural response to economic skills obsolescence and allow cross-pathways from burnout and engagement to both outcomes. This approach recognises that impaired health and reduced motivation may each manifest in either more frequent or longer sickness absence.

3.2.2 Health-impairment process

Burnout –defined as a state of chronic exhaustion and cynicism toward work– is a well-established outcome of prolonged resource loss and a strong predictor of sickness absence (Borritz et al., 2006; Demerouti et al., 2001; Schaufeli et al., 2009). According to COR theory, employees exposed to continuous stressors such as economic skills obsolescence expend increasing amounts of energy to maintain performance. Over time, this depletes emotional and physical resources, resulting in exhaustion and detachment. JD-R theory frames this as a health-impairment process in which excessive demands erode employees' capacity to function and recover (Bakker et al., 2003). Empirical studies support this link: older employees who perceive themselves as lacking the necessary skills report higher end-of-day fatigue and stronger need for recovery (Gom-

mans et al., 2017). When recovery becomes insufficient, burnout develops and may translate into sickness absence as employees attempt to restore depleted resources.

This leads to the following hypotheses:

Hypothesis 1a: Mediated by burnout, economic skills obsolescence is positively related to sickness absence duration.

Hypothesis 1b: Mediated by burnout, economic skills obsolescence is positively related to sickness absence frequency.

3.2.3 Motivational process

Work engagement –a positive, fulfilling work-related state characterised by vigour, dedication, and absorption (Schaufeli & Bakker, 2004)– represents the motivational counterpart to burnout. Within the JD–R model, work engagement arises when employees perceive sufficient resources to meet job demands. Conversely, a persistent lack of resources, as in the case of economic skills obsolescence, weakens this motivation (Hobfoll et al., 2018). Empirical research has shown that employees who perceive a poor fit between their skills and job requirements report lower vitality, satisfaction, and commitment (Jones et al., 2004; McGuinness et al., 2021; Ybema et al., 2011; Follmer et al., 2018). This reflects a motivational loss cycle: when employees invest effort without restoring or gaining resources, their sense of accomplishment diminishes, leading to disengagement (Hobfoll, 2002). Because older employees are less likely to change jobs (Rubenstein et al., 2018), this disengagement is more likely to be expressed through sickness absence rather than turnover.

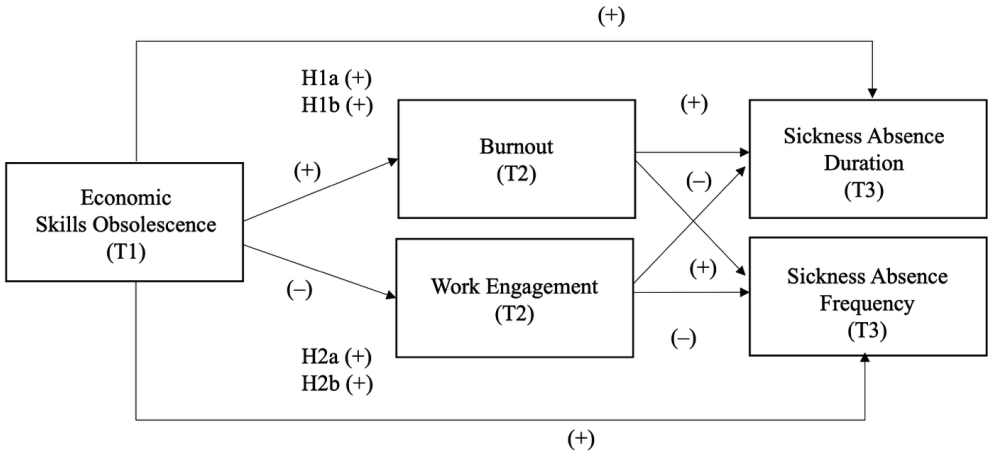
This leads to the following hypotheses:

Hypothesis 2a: Mediated by lower work engagement, economic skills obsolescence is positively related to sickness absence frequency.

Hypothesis 2b: Mediated by lower work engagement, economic skills obsolescence is positively related to sickness absence duration.

Figure 3.1 presents the hypothesised dual-path model that gives an overview of the expected relationships between economic skills obsolescence, burnout, work engagement, and sickness absence.

Figure 3.1 Expected relationships between economic skills obsolescence and sickness absence and the underlying mechanisms.



Notes. T = time. H = hypothesis; the direction of the relationship is indicated in parentheses as (+) or (-).

3.3 Method

3.3.1 Study design

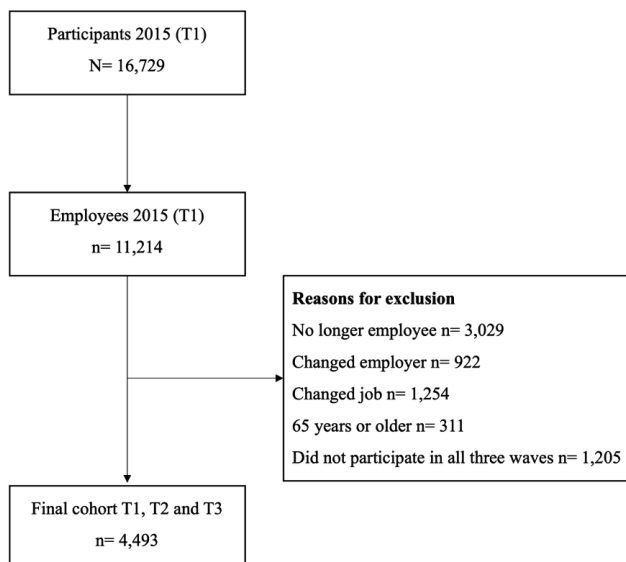
We used longitudinal panel data from the 2015, 2016 and 2017 waves of the Study on Transitions in Employment, Ability and Motivation (STREAM). STREAM is a longitudinal, stratified cohort study among Dutch employees, self-employed employees and non-working persons aged 45–64 years, designed by TNO to provide insight into factors that influence employment transitions among older employees and to identify conditions that promote sustained productivity and good health later in working life. The study population has been described extensively elsewhere (e.g., Leijten et al., 2013; Scharn et al., 2017; Steensma, 2011; Ybema et al., 2014).

In 2015, adaptations were made to the STREAM questionnaire, including the introduction of an updated version of the Utrecht Burnout Scale (UBOS; Schaufeli, 2003). Because burnout is a central variable in the present analyses, the 2015 wave served as the baseline measurement. This wave also included a replenishment sample to restore representation in the 45–49 age group, and additional respondents were recruited in the 50–54, 55–59 and 60–64 categories. In total, 16,729 participants completed the questionnaire in 2015 (11,214 employees, 1,150 self-employed and 4,365 non-employed).

To analyse the longitudinal associations between economic skills obsolescence and sickness absence, we used data from the 2015 baseline (Time 1; T1), the 2016 follow-up measurement (Time 2; T2) and the 2017 follow-up measurement (Time 3; T3). Respondents who were no longer employed at T2 or T3 were excluded, because sickness absence cannot meaningfully be defined for non-employed individuals and cannot be distinguished from vacation days or non-working days among the self-employed. To ensure that economic skills obsolescence measured at T1 referred to the same job context as sickness absence measured at T3, participants who changed employer or job between T1 and T3 were also excluded. Moreover, we excluded employees aged 65 years or older, as 65 was at that time the mandatory retirement age in the Netherlands.

We also excluded participants who did not take part in all three measurement waves. These selection steps resulted in a final sample of 4,493 employees aged 45–64 years working across sectors such as education, health care, manufacturing and services. Figure 3.2 describes the exclusion of the various groups of non-employees in more detail and Appendix 3A shows that excluded participants did not differ significantly from the final sample on baseline economic skills obsolescence, absence duration, absence frequency, burnout or work engagement. Appendix 3B presents the demographic composition of the final sample, including distributions across age groups, sex and educational level. This indicates that the final sample is demographically diverse and that its baseline characteristics are comparable to those of excluded respondents, supporting the adequacy of the final sample for analysis.

Figure 3.2. Flow chart of the exclusion procedure



3.3.2 Measures

Economic skills obsolescence was measured with the item “I lack ‘new’ knowledge and skills that have become important as a result of changes in my work”. This item captures the core of economic skills obsolescence as described by De Grip and Van Loo, namely the perceived decline in the value of one’s skills due to technological and organisational developments that alter job requirements. Responses ranged from 1 (“strongly disagree”) to 5 (“strongly agree”), with higher scores indicating higher perceived economic skills obsolescence.

Burnout was measured with five items from the adapted version of the Utrecht Burnout Scale that was introduced in the 2015 STREAM wave (Schaufeli & Van Dierendonck, 2000). Respondents indicated how often they perceived each feeling on a seven-point scale ranging from 1 (“never”) to 7 (“every day”). Higher scores indicate higher levels of burnout. Internal consistency was high (Cronbach’s $\alpha = .91$). The five items were:

- At the end of the working day, I feel empty.
- I feel used up when I get up in the morning and have to face another day on the job.
- I feel burned out by my work.
- I feel emotionally drained by my work.
- I feel completely exhausted by my work.

Work engagement was measured with six items from the Utrecht Work Engagement Scale used in STREAM (Schaufeli, 2003). Respondents indicated how often they perceived each feeling on a seven-point scale ranging from 0 (“never”) to 6 (“every day”). Higher scores reflect higher work engagement. Internal consistency was high (Cronbach’s $\alpha = .94$). The six items were:

- At my job I feel bursting with energy.
- I feel strong and vigorous at my work.
- When I get up in the morning, I feel like going to work.
- I am enthusiastic about my job.
- My job inspires me.
- I am proud of the work that I do.

Sickness absence was measured at T1 and T3 with two questions asking participants (i) how many working days they had been absent in the past 12 months and (ii) how many times they had been absent during that period. These responses yielded both the total number of absence days and the number of absence episodes. In line with Bakker et al. (2003), two indicators were derived: absence frequency (number of episodes) and average absence duration (mean number

of days per episode). Average absence duration was calculated by dividing the total number of absence days by the number of episodes (Ten Brummelhuis et al., 2013). Although this operationalisation conceptually distinguishes duration from frequency, the two indicators remain correlated (.88).

Control variables included age (in years), sex (male; female) and educational level (low = primary education; medium = secondary general or vocational education; high = higher professional or academic education). In addition, we controlled for employees' general health and their mental and physical workload, as these factors have repeatedly been associated with sickness absence (e.g., Schaufeli et al., 2009).

General health was measured with the item "In general, would you say your health is...", rated from 1 ("excellent") to 5 ("poor") (Thomson et al., 2020).

Mental workload was assessed with three items from the Netherlands Working Conditions Survey, rated from 1 ("never") to 5 ("always"). Higher scores indicate higher mental workload. Internal consistency was good (Cronbach's $\alpha = .80$). The three items were:

- Does your work require a lot of your attention?
- Does your work require you to remember a lot of things?
- Does your work demand a high level of concentration?

Physical workload was measured with five items from the Dutch Musculoskeletal Questionnaire, also rated from 1 ("never") to 5 ("always"). Higher scores reflect higher physical workload. Internal consistency was good (Cronbach's $\alpha = .86$). The five items were:

- Does your work require you to use a lot of force (for example lifting, pushing or pulling)?
- Does your work require you to work in a bent or twisted posture?
- Does your work require you to perform repetitive movements?
- Does your work require you to work above shoulder height?
- Does your work require you to stand for long periods?

Finally, to account for pre-existing differences in sickness absence, baseline levels of the two outcome variables, absence frequency and average absence duration, measured at T1 were included as controls.

3.3.3 Statistical analysis

Descriptive statistics and Spearman correlations were first computed to describe the sample. We then estimated a parallel multiple-mediation model to test the indirect effects of economic skills obsolescence on sickness absence through burnout and work engagement. In this model, average absence duration and absence frequency at Time 3 (T3) serve as the outcome variables, burnout and work engagement at Time 2 (T2) as mediators, and economic skills obsolescence at Time 1 (T1) as the independent variable.

We applied the Preacher and Hayes (2008) bootstrap procedure for multiple mediation in *R* (R Core Team, 2018). This approach avoids the limitations of stepwise methods and enables formal testing of the specific indirect effects, the total indirect effect and the total effect. The model uses four ordinary-least-squares (OLS) regressions to estimate the direct paths, followed by bootstrapping to generate bias-corrected 95 percent confidence intervals for the indirect effects. Only indirect effects were theoretically expected, because the conceptual framework assumes that the relationship between economic skills obsolescence and sickness absence operates through health impairment and motivational decline. Direct paths were estimated as part of the model but were not formulated as hypotheses.

We controlled for employees' age, sex, education, general health, mental workload and physical workload, as these variables are known to relate to work engagement and sickness absence (e.g., Schaufeli et al., 2009). We also controlled for baseline levels of absence frequency and average absence duration measured at T1. To strengthen temporal ordering between economic skills obsolescence, mediators and outcomes, economic skills obsolescence was measured at T1, burnout and work engagement at T2, and both sickness absence indicators at T3¹. Model fit was assessed in *R* using the Tucker–Lewis Index (TLI), the Comparative Fit Index (CFI) and the root-mean-square error of approximation (RMSEA). Because χ^2 tests tend to be significant with large samples, these indices provide a more reliable indication of model fit. TLI and CFI were both 0.99, indicating excellent fit, and the RMSEA was 0.05 (90% CI 0.04–0.06), which also reflects good model fit (Hu & Bentler, 1999). Standardised regression coefficients (β) are reported with 95% confidence intervals (CI).

¹ Although this longitudinal design provides temporal separation between these variables, it does not eliminate the possibility of reciprocal relationships.

3.4 Results

3.4.1 Descriptive statistics and Spearman correlations

Table 3.1 presents the descriptive statistics and Spearman correlations for all study variables. Economic skills obsolescence at T1 correlates positively with average sickness absence duration at T3 ($r_s = .05, p < .001$) and with sickness absence frequency ($r_s = .06, p < .001$). The expected mediation patterns also emerge. Economic skills obsolescence correlates positively with burnout ($r_s = .25, p < .001$) and negatively with work engagement ($r_s = -.20, p < .001$). Burnout shows positive correlations with both sickness absence duration ($r_s = .22, p < .001$) and frequency ($r_s = .22, p < .001$), whereas work engagement correlates negatively with absence duration ($r_s = -.15, p < .001$) and frequency ($r_s = -.16, p < .001$).

Among the control variables, self-rated health and both workload indicators significantly correlate with burnout, work engagement and the two sickness absence measures. Age, sex and education are not meaningfully associated with either outcome. Average absence duration is computed by dividing the total number of days absent in the past 12 months by the number of sickness absence episodes. As a result, average sickness duration and frequency are mathematically dependent. This structural dependency produces the expected strong inter-correlations between both indicators at T1 ($r_s = .88, p < .001$) and T3 ($r_s = .96, p < .001$).

Table 3.1 Descriptive statistics and Spearman correlations

	M	SD	1	2	3	4	5	6	7	8	9	10	11	12
1. Average absence duration T3	4.82	22.97												
2. Absence frequency T3	1.56	6.71	.88***											
3. Economic skills obsolescence	2.56	0.96	.05***	.06***										
4. Burnout	2.10	1.20	.22***	.22***	.25***									
5. Work engagement	4.24	1.21	-.15***	-.16***	-.20***	-.45***								
6. Average absence duration T1	6.47	21.92	.96***	.20***	.06***	.25***	-.17***							
7. Absence frequency T1	1.34	5.55	.39***	.88***	.08***	.20***	-.13***	.95***						
8. Health	2.67	0.83	.20***	.21***	.12***	.34***	-.30***	.25***	.25***					
9. Mental workload	4.09	0.70	.04**	.05**	.00	.16***	.09***	.05**	.06***	.01				
10. Physical workload	1.89	0.92	.06***	.05**	.03	.10***	-.03*	.06**	.04*	.10***	-.10***			
11. Age	53.12	5.33	.03*	.00	-.05**	-.05**	.03*	.00	-.01	.04*	.04*	.01		
12. Education ^a	2.08	0.77	-.03*	.00	.03*	.09***	-.03	-.03	.01	-.06***	.21***	-.31***	-.10***	
13. Sex ^b	0.53	0.50	.00	-.03*	.03*	.01	-.04**	-.02	-.02	-.03	.06***	-.02	.11***	.02

Notes. * $p < .05$. ** $p < .01$. *** $p < .001$. ^a Education is coded as 0 = lower, 1 = middle/ higher.

^b Sex is coded as: 0 = female, 1 = male. T = time. M = mean. SD = standard deviation.

3.4.2 Hypotheses testing

Table 3.2 shows the direct and indirect effects – via burnout and work engagement – of economic skills obsolescence on sickness absence. This multiple-mediation model is significant ($p < .001$) and explains 10% of the variance in average sickness absence duration and 11% in sickness absence frequency.

Hypothesis 1a predicts that economic skills obsolescence is positively related to sickness absence duration through burnout. Economic skills obsolescence at baseline is positively associated with burnout at follow-up ($\beta = .12$, $SE = .02$, 95% $CI [.09, .15]$, $p < .001$). Burnout is positively associated with sickness absence duration ($\beta = .15$, $SE = .01$, 95% $CI [.11, .18]$, $p < .001$). The bootstrap test shows a significant indirect effect of economic skills obsolescence on sickness absence duration through burnout ($\beta = .04$, $SE = .01$, 95% $CI [.02, .05]$). Hypothesis 1a is therefore supported.

Hypothesis 1b proposes that economic skills obsolescence is positively related to sickness absence frequency through burnout. The relationship between economic skills obsolescence and burnout is significant and burnout is positively related to sickness absence frequency ($\beta = .14$, $SE = .01$, 95% $CI [.12, .16]$, $p < .001$). The indirect effect via burnout is significant ($\beta = .05$, $SE = .01$, 95% $CI [.02, .06]$). Therefore, Hypothesis 1b is supported.

Hypothesis 2a predicts that economic skills obsolescence is positively related to sickness absence frequency through lower work engagement. Economic skills obsolescence is negatively associated with work engagement ($\beta = -.16$, $SE = .02$, 95% $CI [-.18, -.13]$, $p < .001$). Work engagement is negatively associated with sickness absence frequency ($\beta = -.11$, $SE = .02$, 95% $CI [-.12, -.04]$, $p < .001$), and the indirect effect via engagement is significant ($\beta = .06$, $SE = .01$, 95% $CI [.02, .07]$), therefore supporting Hypothesis 2a.

Hypothesis 2b predicts that economic skills obsolescence is positively related to sickness absence duration through lower work engagement. The relationship between economic skills obsolescence and work engagement is significant and work engagement is negatively associated with sickness absence duration ($\beta = -.10$, $SE = .02$, 95% $CI [-.11, -.02]$, $p < .001$), and the indirect effect is significant ($\beta = .05$, $SE = .01$, 95% $CI [.02, .07]$). Hypothesis 2b is therefore supported.

Direct effects of economic skills obsolescence on both sickness absence outcomes are non-significant, which is consistent with the hypothesised indirect pathways through burnout and work engagement.

Control variables show several significant associations, but do not change the mediation results. Poorer self-rated health is associated with higher burnout ($\beta = .31$, $SE = .02$), lower work engagement ($\beta = -.28$, $SE = .02$), longer absence duration ($\beta = .18$, $SE = .02$), and higher absence frequency ($\beta = .16$, $SE = .02$). Mental workload is positively associated with burnout ($\beta = .13$, $SE = .02$, 95% CI [.11, .16]) and work engagement ($\beta = .11$, $SE = .02$, 95% CI [.08, .13]). Education is positively associated with burnout ($\beta = .06$, $SE = .02$, 95% CI [.03, .09]) and negatively with work engagement ($\beta = -.05$, $SE = .02$, 95% CI [-.08, -.02]), thus higher education is associated with higher burnout and lower work engagement. Sex is negatively associated with work engagement ($\beta = -.05$, $SE = .04$, 95% CI [-.08, -.02], $p = .003$) and with absence duration ($\beta = -.02$, $SE = .03$, 95% CI [-.11, -.03]), thus females report lower work engagement and higher absence duration.

Table 3.2. Direct and indirect relationships between economic skills obsolescence and sickness absence through burnout and work engagement

	Burnout			Work engagement			Absence duration ^a			Absence frequency		
	β	SE	95% CI	β	SE	95% CI	β	SE	95% CI	β	SE	95% CI
Economic skills obsolescence	.12***	.02	.09, .15	-.16***	.02	-.18, -.13	-.01	.02	-.02, .04	-.01	.02	-.03, .02
Burnout				-.42***	.02	-.57, -.50	.15***	.01	.11, .18	.14***	.01	.12, .16
Work engagement	-.42***	.02	-.57, -.50				-.10***	.02	-.11, -.02	-.11***	.02	-.12, -.04
Health	.31***	.02	.29, .34	-.28***	.02	-.30, -.25	.18***	.02	.13, .23	.16***	.02	.15, .25
Mental workload	.13***	.02	.11, .16	.11***	.02	.08, .13	.03	.02	-.01, .09	.02	.03	-.01, .08
Physical workload	.10***	.02	.08, .13	-.02	.02	-.05, .01	.00	.02	-.03, .05	.01	.02	-.04, .04
Age	-.03	.01	-.03, .00	.00	.01	-.01, .05	.01	.01	-.02, .05	.00	.01	-.03, .06
Education ^b	.06**	.02	.03, .09	-.05**	.02	-.08, -.02	-.00	.02	-.04, .03	.01	.02	-.06, .02
Sex ^c	.01	.03	-.01, .03	-.05*	.04	-.08, -.02	-.02*	.03	-.11, -.03	-.03*	.03	-.01, -.00
Absence duration T1							.14***	.01	.09, .15			
Absence frequency T1										.09***	.01	.07, .12
Pseudo R ²	.14			.12							.11	
Bootstrap indirect effect												
	Via burnout			Via work engagement								
Absence duration ^d	β	SE	95% CI	β	SE	95% CI						
	.04***	.01	.02, .05	.05***	.01	.02, .07						
Absence frequency	.05***	.01	.02, .06	.06***	.01	.02, .07						

Notes. N = 4,391. $p < .05$, ** $p < .01$, *** $p < .001$. Standardised coefficients are reported. Bootstrap sample size = 5,000. ^a Average absence duration. ^b Education is coded as 0 = lower, 1 = middle/ higher. ^c Sex is coded as 0 = female, 1 = male. CI = confidence interval. SE = standard error. T = time. Indirect effects are tested using bootstrapped confidence intervals. Indirect effects are considered statistically significant when the bootstrapped 95% confidence interval does not include zero.

3.5 Discussion

Our multidisciplinary study is the first to address the relevance of economic skills obsolescence as a stressor that induces employees' strain to cope with the impact of rapid technological changes in their work. Across a three-wave longitudinal study among older employees from various industries, our findings suggest that economic skills obsolescence is related to employees' sickness absence. More specifically, we found that employees with economic skills obsolescence report higher levels of burnout and lower levels of work engagement, both of which are related to average sickness absence duration and sickness absence frequency. These findings are consistent with the theoretical expectations derived from the JD-R and COR frameworks, which posit that work stressors deplete psychological and energetic resources, leading to impaired health and reduced motivation.

The simultaneous mediation effects of burnout and work engagement confirm that economic skills obsolescence can trigger both a health-impairment process and a motivational withdrawal process. This suggests that the perception of economic skills obsolescence not only drains energy but also erodes work engagement, resulting in higher levels of sickness absence. Our study also adds to the findings of Schaufeli et al. (2009) and Ten Brummelhuis et al. (2013) that average absence duration and frequency have similar causes.

3.5.1 Implications

In today's labour market, where organisations across various industries struggle to recruit adequately skilled employees, it is essential to invest in the skills of a company's current workforce. This includes older employees who perceive economic skills obsolescence. In such cases, economic skills obsolescence reflects changes in job tasks and skill requirements following technological change, whereby previously sufficient skills lose value due to changing job requirements (Spitz-Oener, 2006; Neuman & Weiss, 1995; Allen & De Grip, 2012). Organisations should be aware that economic skills obsolescence is a work stressor that decreases work engagement and increases burnout and sickness absence. As technological advancements, such as the rise of AI, accelerate changes in job requirements, employees may perceive increasing economic skills obsolescence in the coming years. Such developments can heighten job demands and reduce perceived control, increasing the risk of burnout and subsequent sickness absence. Organisations should therefore monitor economic skills obsolescence proactively as an early-warning indicator for work-related strain and sickness absence.

Also, lifelong learning and related pro-active HR practices should be promoted to enable older employees to keep their skills up-to-date and remain employable (De Grip et al., 2020). To achieve this, organisations could help older employees to get a complete picture of their current skills and opportunities for further skill development. This will strengthen employees' feelings of competence in performing their job and help them to prevent or overcome economic skills obsolescence, which will lower their work-related stress. Older employees would then be less inclined to call in sick when perceiving or fearing economic skills obsolescence and continue working healthy and motivated instead.

3.5.2 Strengths, limitations and future research

This study is the first that studies the relationships between economic skills obsolescence and sickness absence. A major strength is the use of longitudinal data. The rich data over three data points allowed us to examine the relationships as a process that occurs over the years. The use of both absence variables enabled us to estimate an integrated model. Moreover, we controlled our estimates on average absence duration and frequency for the baseline levels of the outcome variable.

While efforts have been made to test a robust model, our study has some limitations. All variables were derived from self-report measures, raising concerns about common method bias (Jordan & Troth, 2020). However, STREAM followed recommendations for controlling the influence of common method bias, such as using validated scales (Jordan & Troth, 2020). In addition, self-reported sickness absence is a valid method for measuring sickness absence that relates well to company-registered absence data (Johns & Miraglia, 2015), particularly because in the Netherlands sickness absence is clearly defined, as all days of absence are company-registered as days of sickness that can be checked by an occupational health and safety service or company doctor.

Some additional limitations concerning the sickness absence data should be kept in mind. First, the two sickness absence indicators are mathematically intertwined because average absence duration is derived by dividing the total number of absence days by the number of episodes. This structural dependence results in high correlations and limits the extent to which their effects can be interpreted as fully independent (Ten Brummelhuis et al., 2013). Second, the two pathways to sickness absence, through burnout and work engagement, also show empirical overlap, as employees reporting higher burnout tend to report lower work engagement (see Table 3.1). This interrelation does not invalidate

the dual-pathway approach, but it does indicate that motivational and health-impairment processes may partially co-occur.

A final limitation is the low percentage of variance explained by the research models, although the pseudo R^2 in our study corresponds with prior research on sickness absence (e.g., Schaufeli et al., 2009; Van der Burg et al., 2020), reflecting that sickness absence is influenced by a wide range of factors such as physical and mental health, organisational culture, job insecurity and personal circumstances. Future research could therefore explore other mediators between economic skills obsolescence and sickness absence, such as job insecurity and organisational support, to capture a more comprehensive picture of the pathways linking economic skills obsolescence to sickness absence.

Given the scarcity of available research, it is important to continue examining economic skills obsolescence. We encourage future research to use alternative approaches, such as more in-depth case studies as well as examining the effects of economic skills obsolescence on younger employees. An interesting future research avenue could also be the study of technical skills obsolescence due to illness, ageing, or non-use (De Grip & Van Loo, 2002; Arthur & Day, 2020) and its relationship with economic skills obsolescence. This is particularly relevant for employees who have been absent from work for an extended period, who might also face economic skills obsolescence when they aim to return to work. Finally, it would be valuable to examine measures to reduce economic skills obsolescence and prevent its negative consequences.

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3.6 Appendices

Appendix 3A. Baseline comparison means of included and excluded participants

	Final sample Mean	Excluded participants Mean	Significance
Economic skills obsolescence	2.56	2.57	n.s.
Average absence duration	4.82	4.80	n.s.
Absence frequency	1.56	1.47	n.s.
Work engagement	4.24	4.36	n.s.
Burnout	2.10	2.12	n.s.

Notes. n.s. = not significant.

Appendix 3B. Demographical composition of the final sample

	n	%
Male	2,398	53.4
Female	2,095	46.6
Age in 2015 (T1)		
45–49 years	1,506	33.5
50–54 years	1,060	23.6
55–59 years	1,204	26.8
60–64 years	722	16.1
Age in 2017 (T3)		
45–49 years	884	19.7
50–54 years	1,262	28.1
55–59 years	1,150	25.6
60–64 years	1,197	26.6
Education		
Lower	1,144	25.5
Middle	1,826	40.6
Higher	1,523	33.9

Notes. T = time.

4

Economic skills obsolescence and development opportunities at work: the relationships with sickness absence and work engagement

This chapter is a slightly adjusted version of a paper co-authored with Tinka van Vuuren that has been published in het Tijdschrift voor Arbeidsvraagstukken:

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<https://doi.org/10.5117/TVA2022.2.005.MESS>

4.1 Introduction

Technological developments follow one another at increasing speed, changing employees' job content and the job structures within organisations, and the skills needed to perform effectively (Acemoglu & Restrepo, 2019; Cascio & Montealegre, 2016; Deming & Noray, 2018). Although virtually all sectors of industry are affected, these changes are particularly disruptive for employees in finance, technology, and ICT (Asimakopoulos & Whalley, 2017; Cedefop, 2018; McGuinness et al., 2021; Tsai et al., 2007). Such rapid shifts in skill demands can lead to economic skills obsolescence, i.e., a situation in which employees no longer possess the up-to-date knowledge and skills required to perform their jobs adequately (Sanders & Kraan, 2013; Van Loo et al., 2001). The capacity to continuously learn and adapt has therefore become essential for employees' long-term participation and continued functioning in the labour market.

The literature distinguishes between *technical* and *economic* skills obsolescence. Technical skills obsolescence refers to the decline or loss of skills through ageing, illness, accidents, or prolonged disuse. Economic skills obsolescence, the focus of this study, refers to a decrease in the value of an employee's human capital caused by a shift in the skills required for their jobs due to technological or organisational changes in the work environment, resulting in a mismatch between employees' current skills and those required in their jobs and in the broader labour market (De Grip & Van Loo, 2002; Neuman & Weiss, 1995).

Economic skills obsolescence has been related to lower work performance, reduced job security, poorer health, and lower job satisfaction (Allen & De Grip, 2012; Jones et al., 2004; Sanders & Kraan, 2013). Recent longitudinal evidence among older employees shows that higher economic skills obsolescence is associated with lower work engagement and higher sickness absence (see Chapter 3). As employees in many countries are required to work longer before reaching their retirement age, maintaining up-to-date skills throughout an extended career has become essential. While formal training programmes contribute to employees' employability, several studies emphasise that informal learning embedded in everyday work is the main driver of employees' skill development (Borghans et al., 2014; Van den Berg et al., 2018).

Despite increasing awareness of the importance of lifelong learning, many organisations still focus predominantly on formal training and overlook the learning potential present in daily tasks (De Grip, 2015). One way to activate this potential is to provide development opportunities at work, which refer to opportunities embedded in daily work. These opportunities support employees'

professional growth and may strengthen their ability to deal with changing skill demands (Van der Heijden et al., 2015).

This study examines how economic skills obsolescence and development opportunities at work are related to sickness absence, and whether work engagement mediates these relationships. In addition, we describe the prevalence of economic skills obsolescence and the types of obsolete skills reported across different age groups. For our analyses, we use cross-sectional data from 1,444 employees of a large Dutch telecommunications company.

This study contributes to the literature in two main ways. First, it offers insight into the types of skills employees perceive as outdated across different age groups, thereby extending existing knowledge on how economic skills obsolescence manifests in organisations undergoing technological change. Second, it highlights the role of development opportunities at work in sustaining employees' skills and reducing the risk of withdrawal behaviour associated with work-related strain. In doing so, the study further elaborates on the mechanisms linking economic skills obsolescence, work engagement, and sickness absence.

4.2 Theoretical background and hypotheses

4.2.1 Job Demands–Resources (JD–R) theory

The Job Demands–Resources (JD–R) theory proposes that jobs consist of both demands and resources. Job demands refer to aspects of work that require sustained physical or psychological effort, such as workload, time pressure, or changing skill requirements. Such demands may deplete employees' energy and psychological resources, leading to strain, reduced work engagement, and higher sickness absence (Bakker et al., 2003; Schaufeli et al., 2009). Job resources, by contrast, support learning, motivation, and effective functioning, and include autonomy, feedback, and opportunities for development. These resources stimulate growth and engagement and buffer the negative effects of job demands.

Within this framework, economic skills obsolescence functions as a job demand because employees may perceive a loss of skill value as a source of strain that requires continued adaptation and effort. As skills lose their value in evolving work contexts, employees may perceive reduced competence and control in meeting changing job demands. Development opportunities at work serve as a job resource because they enable learning, adaptation, and motivation

in response to changing job demands. Employees who perceive high levels of economic skills obsolescence combined with limited development opportunities may therefore be more vulnerable to disengagement and higher sickness absence.

4.2.2 Economic skills obsolescence as a job demand

Economic skills obsolescence refers to employees' perceived loss of skill value over time due to technological, organisational or labour market changes that alter job requirements (Allen & De Grip, 2012; Jones et al., 2004; Neuman & Weiss, 1995). Technological and organisational changes occur at an accelerating pace, increasing the likelihood that existing skills lose value (Allen & De Grip, 2012; McGuinness et al., 2021; Sanders & Kraan, 2013; Van Loo, 2007). European labour market analyses indicate that a substantial share of employees is exposed to the risk of economic skills obsolescence, particularly in sectors characterised by rapid technological change, digitalisation, and evolving task requirements, such as ICT, technical services, finance, and engineering. Based on the European Skills and Jobs Survey, around ten percent of Dutch employees face a high risk of economic skills obsolescence due to these developments (Cedefop, 2018). More recent European labour market reports confirm that technological change and digitalisation continue to reshape skill requirements across sectors, sustaining the structural risk of skills mismatch and obsolescence (Cedefop, 2024; OECD, 2025).

Demands for advanced ICT skills, complex cognitive skills including problem-solving and learning, and socio-emotional skills such as communication, planning, and customer orientation have risen sharply over the past two decades and are expected to continue rising (Cedefop, 2018; Van den Berg et al., 2018). To sustain their performance and employability, employees must therefore continually update and expand their skill set (Allen & De Grip, 2012; McGuinness et al., 2021). When changing job requirements outpace employees' opportunities to adapt, their productivity and work engagement may decline.

Three forms of economic skills obsolescence are commonly distinguished (De Grip & Van Loo, 2002; Sanders & Kraan, 2013):

- Job-related obsolescence occurs when job content changes and new skills are required. Employees may feel that their skills are less valued and that they lack newly relevant ones.
- Market-driven obsolescence refers to shifts in the labour market that reduce the demand for certain occupations, even when employees remain competent in their current role.

- Firm-specific obsolescence arises when organisational restructuring or redundancy renders company-specific skills less valuable elsewhere.

This study focuses on job-related and market-driven obsolescence, as these forms are most relevant for employability and sickness absence.

Economic skills obsolescence can be measured in several ways: by examining wage developments or by assessing employees' perceptions through survey measures (De Grip & Van Loo, 2002; Neuman & Weiss, 1995). A limitation of using wage development is that wages may be subject to rigidity, for example due to collective labour agreements, making it difficult to determine whether actual skills obsolescence has occurred. In this study, we assess economic skills obsolescence through self-reported measures, reflecting employees' perceptions that their skills are becoming outdated relative to changing job or labour market requirements.

4.2.3 Development opportunities at work as a job resource

Development opportunities at work refer to opportunities embedded in daily work that enable employees to develop themselves, realise their ambitions, learn new skills and use their talents (Van der Heijden et al., 2015). These opportunities reflect the learning potential embedded in everyday work and are strongly associated with informal skill development (Borghans et al., 2014; Künn et al., 2024; Van den Berg et al., 2018). Research shows that informal learning at work is more important for the development of new skills than participation in formal training and education (Borghans et al., 2014; Van den Berg et al., 2018). Employees spend more hours learning during work than in formal training. Providing work in which employees have opportunities to learn new skills therefore constitutes a powerful instrument for keeping up with changes in work (Van der Heijden et al., 2015).

Learning and development are not only important for maintaining productivity in current and future jobs, but also for remaining healthy and enjoying work (Thunnissen & Van Vuuren, 2020). Earlier studies show that both formal and informal learning are associated with lower levels of economic skills obsolescence (Allen & De Grip, 2012; McGuinness et al., 2021). Within the JD–R framework, development opportunities at work function as a key job resource that supports adaptation to changing demands and strengthens employees' capacity.

4.2.4 Sickness absence frequency

Sickness absence refers to employees not attending work due to illness. It is a complex phenomenon influenced by personal, social, and organisational factors such as health, age, gender, job demands, and available resources (Bakker et al., 2003; Johns, 2003; Schaufeli et al., 2009; Van der Burg et al., 2020). Older employees tend to have longer absence duration, whereas younger employees more often report short, frequent absences (Drakopoulos & Grimani, 2013; Van der Burg et al., 2020). Women report sickness absence more frequently than men, partly due to greater caregiving responsibilities, more health complaints and higher stress exposure (Drakopoulos & Grimani, 2013; Johns, 2003).

The work environment also plays an important role (Bakker et al., 2003; Johns, 2003; Schaufeli et al., 2009; Van der Burg et al., 2020). Recent Dutch data show that a substantial share of employees who reported sickness absence indicated that their sickness absence was partly or fully work-related (TNO, 2025). Physical work-related factors, such as accidents, tiring postures and repetitive movements, are frequently reported as causes of sickness absence. Psychosocial factors, including work pressure and intimidation, also contribute. Sickness absence may arise when employees' capacity, including their knowledge and skills, is insufficient to meet job demands. In such cases, workload exceeds capacity (Gründemann & Van Vuuren, 1997; Van Vuuren et al., 1999). For some employees, health complaints may lead to sickness absence, whereas others may continue working despite similar complaints. Sickness absence therefore concerns not only health, but also motivation and the balance between employees' capacity and job demands. It can be understood as an imbalance between the employee and the work environment (Van Dijk et al., 1990).

The literature distinguishes between absence duration and absence frequency (Johns & Al Hajj, 2016; Schaufeli et al., 2009). Absence duration refers to the total number of days absent during a given period. This study focuses on sickness absence frequency, defined as the number of absence spells during a given period, regardless of their duration, because this indicator is less affected by non-normal distributions and more clearly reflects behavioural and motivational withdrawal processes (Steel, 2003).

4.2.5 The demands pathway

Within the JD-R framework, economic skills obsolescence can be understood as a job-related demand that may reduce employees' psychological resources and increase strain. Experiencing economic skills obsolescence may generate

stress, fear of negative consequences for employability and continuous pressure to update skills (Rajeswari & Anantharaman, 2003; Tsai et al., 2007; Santos et al., 2021). It thus creates an imbalance between employees' capacity and job demands. As shown in Chapter 3 of this dissertation, employees who perceive higher economic skills obsolescence report higher sickness absence frequency.

Based on this reasoning, the following hypothesis is tested:

Hypothesis 1: Economic skills obsolescence is positively related to sickness absence frequency.

Work engagement is defined as a positive work-related state characterised by vigour, dedication and absorption (Schaufeli et al., 2009). Economic skills obsolescence may undermine work engagement by increasing job demands and reducing the availability of resources needed to perform effectively. Within the JD–R framework, such imbalances are expected to erode employees' motivation and engagement, which in turn increase the likelihood of withdrawal behaviours such as sickness absence (Bakker & Demerouti, 2007; Schaufeli et al., 2009). Lower work engagement is associated with more frequent sickness absence, whereas higher work engagement has been shown to protect against sickness absence (Schaufeli et al., 2009; Neuber et al., 2021). Previous studies show that economic skills obsolescence is associated with lower vitality and job dissatisfaction (Jones et al., 2004; Ybema et al., 2011). Moreover, Chapter 3 demonstrates that work engagement mediates the relationship between economic skills obsolescence and sickness absence.

This leads to the following hypothesis:

Hypothesis 2: Work engagement mediates the relationship between economic skills obsolescence and sickness absence frequency, such that higher obsolescence is associated with lower engagement, which in turn is associated with higher absence frequency.

4.2.6 The resources pathway

Within the JD–R framework, development opportunities constitute an important job resource because they strengthen employees' capacity to meet job demands and sustain motivation. Informal learning at work plays a crucial role in skill development (Borghans et al., 2014; Van den Berg et al., 2018). Employees who have opportunities to learn and use their talents are better able to adapt to changing skill requirements. Previous research shows that formal and informal

learning are associated with lower levels of economic skills obsolescence (Allen & De Grip, 2012; McGuinness et al., 2021).

This leads to the following hypothesis:

Hypothesis 3: Development opportunities at work are negatively related to economic skills obsolescence.

Furthermore, by enhancing employees' knowledge and skills, development opportunities reduce the imbalance between workload and individual capacity. When capacity is insufficient to meet job demands, workload exceeds capacity, increasing the likelihood of sickness absence (Gründemann & Van Vuuren, 1997; Van Vuuren et al., 1999). By strengthening employees' skills, development opportunities reduce this imbalance and thereby decrease the need to withdraw from work.

Several studies provide indirect support for a negative relationship between development opportunities and sickness absence. Van Vuuren et al. (2011) show that employees who perceive more development opportunities as part of life-long learning report higher work ability, measured using items derived from the Work Ability Index, of which sickness absence forms one component. Favourable psychosocial working conditions and greater decision latitude are associated with lower sickness absence (Niedhammer et al., 1998). Opportunities to learn new skills form part of this decision latitude. A large Danish study shows that limited development opportunities double the risk of long-term sickness absence in emotionally demanding occupations (Framke et al., 2021). Higher educational attainment is also associated with lower sickness absence (Klein Hesselink et al., 2013), partly because higher educated employees participate more frequently in learning and development (Van Vuuren et al., 2011a).

This leads to the following hypothesis:

Hypothesis 4: Development opportunities at work are negatively related to sickness absence frequency.

Finally, work engagement is expected to mediate the relationship between development opportunities and sickness absence frequency. Employees who perceive more development opportunities perceive their work as more meaningful and approach it with greater vigour, dedication and absorption (Albrecht et al., 2021). Previous studies show that development opportunities increase work engagement and motivation (Cooper-Thomas et al., 2018; Van der Heijden et

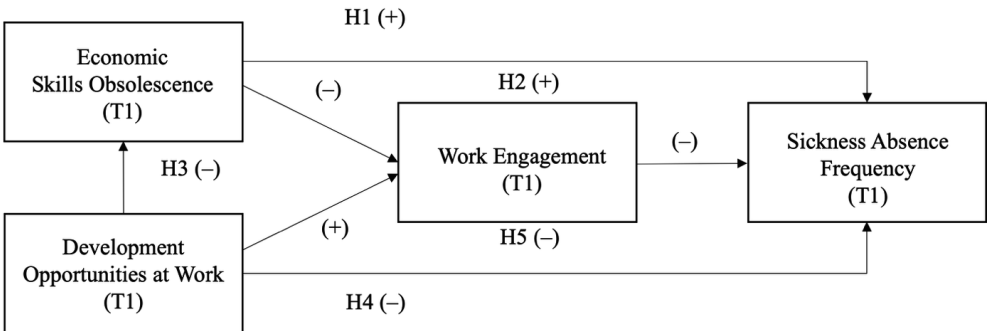
al., 2015; Pak et al., 2019; Van Vuuren et al., 2011a; Van Ruysseveldt et al., 2008; Veth, 2018; Zoomer et al., 2019). Higher work engagement is associated with lower sickness absence (Schaufeli et al., 2009; Neuber et al., 2021).

This results in the final hypothesis:

Hypothesis 5: Work engagement mediates the relationship between development opportunities at work and sickness absence frequency, such that higher development opportunities are associated with higher engagement, which in turn is associated with lower absence frequency.

Figure 4.1 summarises the hypothesised relations between economic skills obsolescence, development opportunities at work, and sickness absence frequency.

Figure 4.1 Hypothesised model of economic skills obsolescence, development opportunities at work and sickness absence frequency, via work engagement.



Notes. T= time. H = hypothesis; the direction of the relationship is indicated in parentheses as (+) or (-). The arrows in the conceptual model reflect hypothesised associations based on theory and prior research rather than causal ordering, given the cross-sectional nature of the data.

4.3 Method

4.3.1 Data collection and sample

Data for this cross-sectional study were collected in 2021 through an online questionnaire administered to employees of a large Dutch telecommunications company. At the time of data collection, approximately 7,000 employees worked for the organisation. The invited employees worked in a business unit consisting of several departments, including customer contact centres, installation and maintenance technicians, and various technical and support departments.

The survey was announced internally, and invitations containing a Qualtrics link were distributed by email. To ensure a reasonable survey length and limit participation fatigue, the questionnaire consisted primarily of short scales and single items (Ohly et al., 2010). Before starting the questionnaire, all participants received information about data protection and privacy and provided written informed consent. In total, 2,731 employees were invited, 1,460 participated, and 1,444 completed the questionnaire in full. These responses were included in the analyses.

4.3.2 Measures

Economic skills obsolescence is usually measured in two ways: through changes in wages (Neuman & Weiss, 1995) or by survey items assessing perceived obsolescence (De Grip & Van Loo, 2002). However, wage-based indicators can be influenced by wage rigidity, such as collective labour agreements, making it difficult to determine whether obsolescence has actually occurred. Self-reported measures, by contrast, capture how employees perceive the loss of value of their skills for their job. In this study, economic skills obsolescence was measured using five items on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). The items were largely adapted from Sanders and Kraan (2013) and cover two dimensions: job-related obsolescence and market-driven obsolescence. Cronbach's $\alpha = .75$. The five items were:

- Tasks I am good at are becoming less important.
- Technological developments make many of my knowledge and skills outdated.
- Much of my knowledge and skills are no longer valued by my organisation.
- My type of work is becoming less common in organisations.
- I lack "new" knowledge and skills that have become important due to changes in my work.

Respondents who (strongly) agreed with one or more items on economic skills obsolescence received a follow-up question about the type of obsolete skills they perceived. Based on the Cedefop skills classification (2018), they could select from nine categories:

- Communication skills
- ICT skills
- Customer service skills
- Planning and organisation
- Problem-solving skills
- Technical skills
- Teamworking skills

- Learning skills
- Other, namely...

Development opportunities at work were measured with a four-item scale adapted from Van der Heijden et al. (2015). Responses were provided on a five-point Likert scale (1 = strongly disagree; 5 = strongly agree). Cronbach's $\alpha = .90$. The four items were:

- In my current job, I can fulfil my ambitions.
- I can develop myself sufficiently in my job.
- My work offers me the opportunity to learn new things.
- At my organisation they make good use of the talents that I possess.

Sickness absence frequency was chosen instead of absence duration because it is less affected by non-normal distributions and better captures motivational withdrawal (Hammer & Landau, 1981; Bakker et al., 2003; Schaufeli et al., 2009). A 12-month reference period was used to increase the stability of the measure. It was measured with two questions: "Have you been absent from work due to illness in the past 12 months?" (yes/no) and, if yes, "How many times have you reported sick during this period?" Respondents who answered "no" were coded as 0.

Work engagement was assessed using a three-item short version of the Utrecht Work Engagement Scale (Schaufeli et al., 2019), measuring vigour, dedication, and absorption. Responses were given on a seven-point scale (1 = never; 7 = every day). Cronbach's $\alpha = .91$. The three items were:

- I feel bursting with energy at my work.
- I am immersed in my work.
- I am enthusiastic about my work.

Control variables included age (in years), educational level (1 = primary education; 5 = university or postgraduate education), and gender (0 = female/non-binary; 1 = male). Previous studies show that older and less educated employees are more vulnerable to economic skills obsolescence (Cedefop, 2018; Van Loo, 2007), and these variables are also known to be associated with sickness absence.

4.3.3 Statistical analysis

All analyses were performed in Stata 17. Inspection of normality assumptions showed that the distribution of sickness absence frequency displayed high kurtosis (8.22). Sickness absence variables are often non-normally distributed due to a large number of "zero absentees" and extreme outliers (Hammer & Landau,

1981; Johns, 2003; Steel, 2003). This may cause employees with unusually high absence frequency to disproportionately influence the results, potentially affecting the accuracy of significance levels. To improve normality, sickness absence frequency was square-root transformed (Weston & Gore, 2006).

Before presenting the descriptive statistics, we report the degree of economic skills obsolescence and the type of obsolete skills by age category. A cut-off score greater than 3 on the five-point scale was used to classify a high level of economic skills obsolescence. Respondents who (strongly) agreed with one or more of the statements received a follow-up question about the specific types of obsolete skills. Then, we examined bivariate relationships between the study variables using Pearson correlations and tested the hypotheses in several steps.

Given the non-normal distribution of sickness absence frequency, direct effects on absence (Hypotheses 1 and 4) were tested using robust regression analyses, which provide reliable estimates when residuals are heteroscedastic or non-normally distributed (Lawrence, 2019). The relationship between development opportunities at work and economic skills obsolescence (Hypothesis 3) was tested using linear regression. The mediation hypotheses (Hypotheses 2 and 5) were tested using Structural Equation Modelling (SEM). In line with the Job Demands–Resources (JD–R) theory, two separate mediation models were estimated, each specifying work engagement as the sole mediator.

The first model examined the demands pathway, in which economic skills obsolescence was specified as a predictor of sickness absence frequency, with work engagement as the mediating variable. The second model examined the resources pathway, in which development opportunities at work were specified as a predictor of sickness absence frequency, again with work engagement as the mediating variable. Estimating both models separately provides a clearer insight into the distinct mechanisms proposed in the JD–R framework.

Model fit was evaluated using the Comparative Fit Index (CFI), Root Mean Square Error of Approximation (RMSEA), and Standardised Root Mean Square Residual (SRMR). Values above .90 for the CFI indicate acceptable model fit and values above .95 indicate good fit. For RMSEA and SRMR, values below .08 indicate acceptable fit (Browne & Cudeck, 1992; Hu & Bentler, 1999). Effects were considered statistically significant when the 95% confidence intervals did not include zero. All analyses controlled for gender, age and educational level. The results are presented as both standardised and unstandardised coefficients with robust standard errors.

4.4 Results

4.4.1 Type of obsolete skills by age group

Table 4.1 summarises the degree of perceived economic skills obsolescence and the types of obsolete skills across age groups. Of the 1,444 respondents, 11% (strongly) agreed with the economic skills obsolescence statements. Twenty-seven percent agreed with at least one item and therefore received a follow-up question on the specific skills involved. Respondents most often identified technical, ICT and problem-solving skills as outdated; none reported obsolete customer-oriented skills. Across all age groups, respondents most frequently identified technical, ICT, and problem-solving skills as outdated, whereas no respondents reported obsolete customer-oriented skills. Younger employees (18–24 years) more frequently reported obsolete problem-solving, planning and organisation, learning, and teamwork skills. From age 25 onwards, respondents increasingly reported obsolete technical skills, while obsolete ICT skills were reported more frequently from age 35 onwards, reaching the highest prevalence among employees aged 55–66 years.

Table 4.1 Type of obsolete skills by age group

	Total	18-24 years	25-34 years	35-44 years	45-54 years	55-66 years
<i>n total sample</i>	1444	66 (5%)	433 (30%)	437 (30%)	320 (22%)	188 (13%)
Economic skills obsolescence	11%	9%	9%	10%	10%	24%
<i>n</i>	395	14	111	103	89	78
Communication ^a	16%	14%	24%	13%	12%	14%
ICT skills	29%	29%	19%	30%	34%	38%
Leadership skills	12%	21%	18%	9%	9%	9%
Planning and organisation	14%	29%	22%	11%	9%	10%
Problem-solving	34%	57%	43%	31%	27%	29%
Technical	46%	29%	41%	47%	44%	56%
Teamwork	20%	29%	28%	17%	13%	18%
Learning	20%	36%	23%	10%	19%	29%
Other skills ^b	14%	-	9%	20%	13%	13%

Notes. ^a Oral and written communication skills. ^b For example, administrative and data analysis skills.

4.4.2 Descriptive statistics and Pearson correlations

Of the 1,444 respondents, 61.4% identified as male, 37.5% as female and 0.3% as non-binary, whereas 0.8% did not specify their gender. Respondents' average age was 40.35 years. The Pearson correlation results in Table 4.2 show that economic skills obsolescence is positively correlated with sickness absence

frequency ($r = .08, p < .01$), indicating that employees who perceive higher economic skills obsolescence report more frequent absence episodes. Economic skills obsolescence is also negatively related to development opportunities at work ($r = -.44, p < .01$) and work engagement ($r = -.42, p < .01$). Economic skills obsolescence is positively associated with age ($r = .09, p < .01$) and negatively with employees' level of education ($r = -.15, p < .01$).

Sickness absence frequency shows negative associations with development opportunities at work ($r = -.18, p < .01$) and work engagement ($r = -.20, p < .01$), suggesting that employees who perceive more development opportunities at work and higher work engagement, report fewer absence episodes. Men report slightly lower sickness absence frequencies than women ($r = -.09, p < .01$). Sickness absence frequency is also negatively related to age ($r = -.19, p < .01$), indicating that older employees report fewer absence spells. Sickness absence frequency is also negatively related.

to educational level ($r = -.08, p < .01$), indicating that lower educational level is associated with more frequent absence spells.

Development opportunities at work are positively associated with work engagement ($r = .66, p < .01$). Development opportunities at work are also positively associated with age ($r = .13, p < .01$), indicating that older employees perceive more opportunities to develop themselves at work. Work engagement shows positive associations with age ($r = .16, p < .001$) and a negative association with education ($r = -.05, p < .05$).

Table 4.2 Pearson correlations

	1	2	3	4	5	6
1. Economic skills obsolescence						
2. Sickness absence frequency	.08**					
3. Development opportunities at work	-.44**	-.18**				
4. Work engagement	-.42**	-.20**	.66**			
5. Gender ^a	.06*	-.09**	-.02	.04		
6. Age	.09**	-.19**	.13**	.16**	.10**	
7. Education ^b	-.15**	-.08**	-.03	-.05*	-.03	-.02

Notes. * $p < .05$. ** $p < .01$. ^aGender is coded as 0 = female/non-binary and 1 = male.

^bEducation is coded as 0 = lower and 1 = middle/ higher educational level.

4.4.3 Hypotheses testing

Table 4.3 presents the results of the robust regression and SEM analyses for the demands pathway in which economic skills obsolescence was specified as a predictor of sickness absence frequency, whereas Table 4.4 presents the results for the resources pathway in which development opportunities at work were specified as a predictor of economic skills obsolescence as well as sickness absence frequency.

Hypothesis 1 predicts that economic skills obsolescence is positively related to sickness absence frequency. Model 1 shows the results of the direct relationship between economic skills obsolescence and sickness absence frequency. The results show a significant positive relationship between economic skills obsolescence and sickness absence frequency ($\beta = .10, p < .001$), indicating that employees who perceive higher levels of economic skills obsolescence report higher sickness absence frequencies. This supports Hypothesis 1.

Hypothesis 2 proposes that work engagement mediates the relationship between economic skills obsolescence and sickness absence frequency. Model 2 shows the results of the relationship between economic skills obsolescence and sickness absence frequency through work engagement. Model fit indices indicate an acceptable fit ($CFI = .98, RMSEA = .08, SRMR = .02$). Economic skills obsolescence is negatively related to work engagement ($\beta = -.44, p < .001$), while work engagement is negatively associated with sickness absence frequency ($\beta = -.16, p < .001$). The indirect effect through work engagement is significant ($B = .07, SE = .01, 95\% CI [.04, .09]$), thus supporting Hypothesis 2.

The mediation results show that the direct effect of economic skills obsolescence on sickness absence frequency is no longer significant ($\beta = .03, p = .69$), suggesting full mediation by work engagement.

Table 4.3 Estimation results of robust regression and SEM analysis of associations between economic skills obsolescence and sickness absence frequency, mediated by work engagement (Demands pathway).

	Model 1				Model 2			
	Sickness absence frequency (without work engagement)		Work engagement		Sickness absence frequency			
	B	SE	B	SE	B	SE	B	SE
Economic skills obsolescence	.09***	.03	.10***	.03	.03	.02	.03	.03
Work engagement	-	-	-	-	-.09***	.03	-.16***	.03
Gender ^a	-.11**	.04	-.08**	.06	-.10**	.04	-.07**	.04
Age	-.01***	.01	-.19***	.02	-.01**	.03	-.16**	.03
Education ^b	-.12*	.05	-.07*	.08	-.12*	.05	-.07*	.05
n	1,392		1,388					
R ²	.05		.46		.25			
CFI			.98					
RMSEA			.08					
SRMR			.02					
Bootstrap indirect effects								
Economic skills obsolescence							LL – UL 95% CI	
					B (SE)		.04, .09	
					.07 (.01)***			

Notes: * $p < .05$. ** $p < .01$. *** $p < .001$.

Standardised and unstandardised coefficients are reported. SE = standard error.

Bootstrap sample size = 2,000.

^a Gender is coded as 0 = female/non-binary and 1 = male.

^b Education is coded as 0 = lower and 1 = middle/ higher educational level.

Hypothesis 3 proposes that development opportunities at work are negatively related to economic skills obsolescence. Model 1 shows the results of the direct relationship between development opportunities at work and economic skills obsolescence. The results show that development opportunities at work are negatively related to economic skills obsolescence ($\beta = -.46, p < .001$), indicating that employees who perceive more development opportunities at work perceive lower levels of economic skills obsolescence. Therefore, Hypothesis 3 is supported.

Hypothesis 4 predicts that development opportunities at work are negatively related to sickness absence frequency. Model 2 shows the results of the direct relationship between development opportunities at work and sickness absence frequency. The results show a significant negative relationship ($\beta = -.17, p < .001$), indicating that employees who perceive more development opportunities at work report sickness absence less frequently. This finding supports Hypothesis 4.

Hypothesis 5 proposes that work engagement mediates the relationship between development opportunities at work and sickness absence frequency. Model 3 shows the results of the relationship between development opportunities at work and sickness absence frequency through work engagement. Model fit indices indicated a good fit (CFI = .97, RMSEA = .06, SRMR = .02). Development opportunities at work are positively associated with work engagement ($\beta = .64, p < .001$), while work engagement is negatively related to sickness absence frequency ($\beta = -.10, p < .01$). The indirect effect of development opportunities at work on sickness absence frequency through work engagement is significant ($B = -.06, SE = .01, 95\% CI [-.09, -.02]$). This supports Hypothesis 5. The direct effect of development opportunities at work on sickness absence remains significant ($\beta = -.12, p < .01$), indicating partial mediation.

4.5 Discussion

This study examines the relationships between economic skills obsolescence, development opportunities at work, and sickness absence frequency among employees of a Dutch telecommunications company. The findings show that 11% of employees in this organisation perceive a relatively high level of economic skills obsolescence, particularly with regard to technical, ICT, and problem-solving skills. This organisation-specific prevalence aligns with broader evidence showing that economic skills obsolescence is most pronounced in technology-intensive sectors characterised by rapid technological change (Cedefop, 2018; OECD, 2025). Younger employees most often report obsolete problem-solving,

planning and organisation, learning, and teamwork skills, whereas older employees (aged 55–66) more frequently report outdated ICT and technical skills.

Economic skills obsolescence is negatively associated with work engagement and positively associated with sickness absence frequency. Employees who perceive higher obsolescence report lower engagement, whereas lower engagement is associated with more frequent absence. These relationships reflect the motivational component of sickness absence described in earlier studies (Johns, 2003; Schaufeli et al., 2009) in which work engagement functions as a pathway linking economic skills obsolescence to sickness absence frequency. When work engagement was included in the analysis, the direct association between economic skills obsolescence and sickness absence was no longer significant, underscoring the central role of work engagement in this relationship.

Development opportunities at work show a countervailing process. Employees who perceive more opportunities to learn report lower economic skills obsolescence and higher work engagement. This aligns with JD–R-theory in which development opportunities act as a job resource that strengthens learning, supports adaptation to changing job demands, and offsets some of the negative consequences of skills obsolescence. Higher perceived development opportunities at work also relate to lower sickness absence frequency, which illustrates the important role of everyday learning in sustaining employability and well-being. In the full structural model, the direct association decreases but remains significant, indicating partial mediation through work engagement.

This pattern aligns with earlier evidence showing that learning and development opportunities strengthen employability and adaptability in changing work environments (Allen & De Grip, 2012; McGuinness et al., 2021). The findings also confirm earlier research demonstrating that access to development opportunities enhances employees' resilience and motivation (Van Vuuren et al., 2011a; Zoomer et al., 2019), which in turn reduce sickness absence (Framke et al., 2021).

Table 4.4 Results of robust regression and SEM analysis of associations between development opportunities at work and sickness absence frequency, mediated by work engagement (Resources pathway).

	Model 1			Model 2			Model 3		
	Economic skills obsolescence			Sickness absence frequency (without work engagement)			Work engagement		
	B	SE	β	B	SE	β	B	SE	β
Development opportunities	-.36***	.02	-.46***	-.13***	.02	-.17***	.95***	.03	.64***
Work engagement	-	-	-	-	-	-	-	-	-
Gender ^a	.04	.03	.03	-.10**	.04	-.08**	.12*	.05	.05*
Age	.01***	.01	.14***	-.01**	.01	-.17***	.01***	.02	.08***
Education ^b	-.09*	.04	-.05*	-.14**	.05	-.08**	.06	.06	.02
N	1,383			1,432			1,427		
R ²	.22			.07			.46		.45
CFI							.97		
RMSEA							.06		
SRMR							.02		
Bootstrap indirect effects									
Development opportunities at work							B (SE)		LL – UL 95% CI
							-.06 (.01) ***		-.09, -.02

Notes. * $p < .05$. ** $p < .01$. *** $p < .001$. Standardised and unstandardised coefficients are reported. SE = standard error. Bootstrap sample size = 2000. ^aGender is coded as 0 = female/non-binary and 1 = male. ^bEducation is coded as 0 = lower and 1 = middle/ higher educational level.

The findings also point to differences between employee groups. Older employees report higher economic skills obsolescence as well as higher development opportunities at work. One explanation is that older employees may be more aware of outdated ICT or job-specific skills and therefore perceive both a stronger need for learning and more opportunities to address these gaps (Van den Berg et al., 2018). At the same time, earlier studies show that older employees participate less often in formal training than younger employees (Fouarge et al., 2018; Van Loo et al., 2001; Van Vuuren et al., 2011b). Accessible and relevant development opportunities in daily work therefore hold particular relevance for older employees in maintaining their employability and reducing absence.

4.5.1 Limitations and suggestions for future research

Some limitations should be considered when interpreting these findings. First, the data are collected exclusively through self-report questionnaires, which may introduce subjectivity and common method bias (Jordan & Troth, 2020). This risk is mitigated by ensuring respondent anonymity and by using short, clearly formulated scales with varied response formats, which helps reduce common method bias (Jordan & Troth, 2020; Spector, 2006). Moreover, prior research shows that self-reported sickness absence is generally reliable and produces similar results to register-based measures (Johns & Miraglia, 2015).

Second, the cross-sectional design of this study prevents drawing causal conclusions. The observed associations are consistent with the longitudinal findings in Chapter 3 and the use of SEM allows the proposed relationships to be tested within a theoretically informed model (Weston & Gore, 2006). However, longitudinal data would increase evidence on causality. Future studies should therefore adopt multi-wave designs that track changes in skills obsolescence, engagement, and sickness absence over time.

Third, the relatively low explained variance in the sickness absence models should be interpreted in context. Sickness absence is multifactorial and shaped by a wide range of determinants, including employees' health status, job characteristics, and personal or organisational factors (Van der Burg et al., 2020; Johns, 2003). In this respect, the low explained variance of our study aligns with earlier research showing that even well-specified models typically explain only modest portions of variance in absence outcomes.

Furthermore, the study focused specifically on job-related and market-driven economic skills obsolescence –two conceptually distinct forms that require different organisational responses (De Grip & Van Loo, 2002): Job-related

obsolescence calls for policies that support continuous skill renewal within the current job, whereas market-driven obsolescence may demand retraining or job mobility to other occupations. Future research could explore these distinctions in greater depth, including how different forms of obsolescence interact with individual and organisational learning strategies.

Finally, although this study was conducted within a single telecommunications company, our findings may generalise to other organisations facing high technological and organisational change. The sample's age and educational composition closely mirror the Dutch working population, particularly within the ICT and telecommunications sectors (CBS, 2021). The study shows that approximately one in ten employees in this organisation perceive a high degree of economic skills obsolescence. This finding is consistent with broader evidence indicating that skills obsolescence is a salient issue in technology-intensive sectors and underscores the importance of continuous learning and skill development.

4.5.2 Recommendations for practice

Organisations and employees face continuous pressure to adapt to technological and organisational change. While Chapter 3 demonstrates that the relationship between economic skills obsolescence and sickness absence exists across sectors, the current study suggests that this relationship is particularly pronounced in environments characterised by rapid innovation.

Yet such a context also provides opportunities. Jobs involving high rates of technological development create rich learning environments that stimulate both informal and formal learning (Allen & De Grip, 2012; McGuinness et al., 2021). The growing demand for ICT, social-emotional, and cognitive skills highlights the need for organisations to support the continuous renewal of these capabilities. Employers therefore have the responsibility to offer access to formal training as well as to ensure that everyday work provides sufficient development opportunities. Work that enables employees to learn on the job allows them to adapt more effectively to changing skill demands. These opportunities may focus particularly on problem-solving, planning, and organising, as such skills are often learned most effectively through daily work practice (Van den Berg et al., 2018).

A notable finding concerns older employees, who report both higher economic skills obsolescence and more development opportunities. One possible explanation is that they are more aware of their declining ICT proficiency and thus perceive a stronger need for training. Although formal training remains the most

efficient way to update employees' ICT skills (Van den Berg et al., 2018), older employees tend to participate less often in formal training, and earlier studies show that they also encounter fewer training opportunities in everyday work practice (Fouarge et al., 2018; Van Loo et al., 2001; Van Vuuren et al., 2011b). Creating work environments that foster learning opportunities appears to increase older employees' participation in training (Allen & De Grip, 2012).

Organisations should therefore ensure that all employees –regardless of age– have access to meaningful opportunities to learn new skills, pursue professional ambitions, and use their talents at work. This would reduce their skills obsolescence, enhance their employability and sustain their motivation, as well as contribute to lower sickness absence rates.

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5

Sickness absence and job insecurity: the roles of technical and economic skills obsolescence

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5.1 Introduction

Rapid technological advances are reshaping labour demand, requiring employees to continuously update their skills to remain employable (Acemoglu & Restrepo, 2019; Selenko et al., 2022). Organisations must respond to these changes by swiftly adapting to evolving job demands (Asimakopoulous & Whalley, 2017; Liébana Cabanillas & Blanco-Encomienda, 2024). While such developments create opportunities for innovation, they may also increase concerns about job insecurity, especially for employees whose careers are disrupted by sickness absence (Van Vuuren et al., 1999).

Sickness absence can limit employees' exposure to workplace innovations, which increases the risk of skills obsolescence (Görllich & De Grip, 2009). In the Netherlands, where sickness absence rates have risen from 4% to 6% over the past decade (CBS, 2024), prolonged absence may affect employees' long-term employability (e.g., Markussen, 2012). Returning employees may struggle to meet evolving job demands, particularly in technology-driven industries, which is associated with higher levels of job insecurity (Stengård et al., 2019).

In the Netherlands, strict employment laws protect employees' rights during sickness absence by requiring continued wage payments and reintegration efforts for up to two years, while prohibiting dismissal during this period (Borghouts – van de Pas & Van Drongelen, 2021; Post, 2005). However, despite these protections, employees may still perceive job insecurity, as skills obsolescence reflects a perceived loss of value of employees' skills due to changing job requirements, which can undermine their employability regardless of whether this is subjectively perceived or objectively observable (Allen & De Grip, 2012; Jones et al., 2004; Joseph & Kuan Koh, 2011; McGuinness et al., 2021).

This study examines how sickness absence duration contributes to job insecurity through skills obsolescence. Drawing on Conservation of Resources (COR) theory (Hobfoll, 1989), we argue that sickness absence depletes valuable work-related resources, such as professional skills and workplace connections, which may trigger a downward spiral of further resource loss (Griep et al., 2021; Ten Brummelhuis et al., 2013). While COR theory is often used to explain how job insecurity leads to further resource depletion (e.g., loss of motivation, increased stress), our study examines how sickness absence itself initiates a resource loss process.

During sickness absence, employees are temporarily removed from workplace interactions, learning-by-doing, training opportunities, and evolving job de-

mands, which may erode their professional skills. In line with COR theory, this initial depletion increases employees' vulnerability to further losses, as obsolete skills may increase their perceived job insecurity. This perspective aligns with prior research demonstrating that interruptions in work continuity can accelerate skills obsolescence and heighten concerns about job retention (Görlich & De Grip, 2009).

We identify skills obsolescence as a key mechanism in this process, distinguishing between two types: technical and economic skills obsolescence. Technical skills obsolescence is primarily internally driven by factors such as ageing or non-use (e.g., due to illness or career interruptions), whereas economic skills obsolescence is externally driven by technological and organisational changes that render previously acquired skills obsolete (Allen & De Grip, 2012; De Grip & Van Loo, 2002; Neuman & Weiss, 1995). While both forms can undermine an employee's employability, their impact may vary depending on job demands and industry characteristics.

This study contributes to the literature in three specific ways. First, we examine the relation between sickness absence duration and job insecurity using a longitudinal design, building on earlier research that either relied on cross-sectional data or focused on reciprocal associations between job insecurity and sickness absence (Griep et al., 2021; Jiang & Lavaysse, 2018). Second, we explicitly model skills obsolescence as a mediating mechanism in the relation between sickness absence duration and job insecurity. Building on the study of Görlich and De Grip (2009), we conceptualise sickness absence as a disruption of work continuity and examine how this disruption is linked to subsequent skills obsolescence and job insecurity.

Third, we distinguish between technical and economic skills obsolescence and incorporate both drivers of skills obsolescence simultaneously in the analytical model. This allows for a systematic examination of how different types of skills obsolescence are theoretically positioned in the relation between sickness absence and job insecurity. In addition, the study offers practical insights for organisations on how to support returning employees and mitigate the risks of skills obsolescence, thereby helping to sustain employability in evolving work environments. Given the potential risks of skills obsolescence following sickness absence, we highlight the need for structured return-to-work policies that help employees stay up to date with workplace developments and reduce concerns about job insecurity.

5.2 Theory and hypotheses

5.2.1 Job insecurity

Subjective job insecurity is defined as a person's concern about the future of their job. It consists of the perceived probability and the perceived severity of losing one's job (Klandermans et al., 2010; Van Vuuren, 1990). This definition of job insecurity aligns with expectancy theory, which analyses an individual's attitude toward a specific event based on beliefs about the likelihood of the event occurring and the value of the expected outcomes (Feather, 1982; Mitchell, 1982; Porter & Lawler, 1968). In the case of job insecurity, the perceived probability of job loss represents the expectancy component, and its perceived severity represents the value component (Klandermans et al., 2010). Both beliefs about the perceived probability and perceived severity are crucial for affective job insecurity: "The more likely it is that a person will lose their job and/or the more severe the consequences of the loss are, the stronger their feelings of job insecurity will be" (Klandermans et al., 1991, p. 41).

Jiang and Lavaysse (2018) describe that both cognitive (beliefs) and affective (emotional state) components are essential for conceptualising job insecurity. Their results show that it is important to treat cognitive job insecurity and affective job insecurity as two separate constructs. Meta-analyses show that job insecurity detracts from employees' well-being (Sverke et al., 2002). Jiang and Lavaysse (2018) found that cognitive job insecurity is less connected to employees' well-being, while affective job insecurity is more closely related to employees' well-being. Based on these studies, we expect that the perception of job insecurity starts with cognitive job insecurity—the perceived probability of losing one's job—followed by affective job insecurity, which reflects the perceived severity of this potential job loss. This assumption aligns with Hartley et al. (1990), who argued that one can only perceive worry or distress about job loss (affective job insecurity) if one first perceives the probability of job loss (cognitive job insecurity).

In this study, we focus on cognitive job insecurity because it is conceptually closer to its antecedents. Specifically, the factors that predict job insecurity, such as organisational changes, employment protection, and skills obsolescence, primarily shape employees' beliefs about the probability of losing their job rather than their immediate emotional responses. This distinction aligns with the findings of Jiang and Lavaysse (2018), who demonstrate that cognitive job insecurity is more directly influenced by workplace characteristics, while affective job insecurity is more strongly linked to employees' well-being.

5.2.2 Sickness absence

Sickness absence refers to an employee's inability to work due to health-related reasons and is typically measured in two ways: absence duration and absence frequency (Aboagye et al., 2019; Antczak & Miszczyńska, 2021; Ten Brummelhuis et al., 2013). Absence duration captures the total length of time an employee remains away from work, whereas absence frequency refers to the number of separate absence episodes within a given period (Bakker et al., 2003). This study focuses on absence duration, as it more accurately reflects the entire work continuity disruption (Johns, 2003). The duration of sickness absence varies: some employees return after only a few days, whereas others remain absent for extended periods. In general, short-term absence can last from a few days to several weeks, whereas long-term absence extends beyond several weeks or months (Bakker et al., 2003; Antczak & Miszczyńska, 2021; Ten Brummelhuis et al., 2013; Virtanen et al., 2006). Although this distinction is often made, what is considered short- versus long-term sickness absence tends to vary across organisational and national contexts.

Research on career interruptions and unemployment highlights the negative consequences of prolonged detachment from work, with effects ranging from several months to years (Görlich & De Grip, 2009; Apergis & Apergis, 2020). Particularly, in industries characterised by rapid technological change, even relatively short absences can hinder employees' ability to return to work, as they risk falling behind on workplace innovations and evolving job expectations (Borghans et al., 2003). Rather than viewing sickness absence as a binary concept, a continuum perspective better captures how sickness absence gradually affects skills obsolescence and job insecurity over time. Our approach aligns with COR theory, which posits that resource depletion occurs progressively rather than as an abrupt event (Hobfoll, 1989).

5.2.3 Sickness absence and job insecurity

Sickness absence has been widely studied in relation to job insecurity, often through the lens of COR theory. COR theory posits that stress arises when individuals perceive a threat to, or actual loss of, valuable work-related resources such as career opportunities, professional standing, or employability (Hobfoll, 1989). Job insecurity is frequently studied as a predictor of unfavourable occupational outcomes. It has been linked to lower job satisfaction, reduced organisational commitment, and adverse physical and mental health effects (Cheng & Chan, 2008; Suari-Andreu et al., 2022; Sverke et al., 2002). Employees experiencing job insecurity often worry about their job stability, which can increase

stress, diminish job satisfaction, and negatively impact mental well-being (De Witte et al., 2016; Shoss, 2017; Van Vuuren, 1990). Furthermore, job insecurity has been associated with higher sickness absence rates, as prolonged stress and uncertainty can contribute to psychological and physiological health issues, potentially leading to withdrawal from the work environment (Blekesaune, 2012; Chirumbolo & Areni, 2005; Griep et al., 2021; Suari-Andreu et al., 2022; Virtanen et al., 2006).

While job insecurity can contribute to sickness absence, the relationship may also operate in the opposite direction. Employees with higher absence rates often face an increased risk of job termination and unemployment (Virtanen et al., 2006; Mastekaasa, 1996; Wagenaar et al., 2014) and a lower probability of maintaining future employment (Markussen, 2012). Although Dutch labour laws provide strong legal protections during sickness absence (Borghouts – van de Pas & Van Drongelen, 2021), these protections do not fully eliminate concerns about long-term employability. Upon returning to work, employees may still risk being sidelined, missing career opportunities, or facing negative perceptions. Previous research showed that prolonged sickness absence can reduce employability and can hinder career progression due to missed workplace developments and learning opportunities (Görllich & De Grip, 2009). This uncertainty is particularly pronounced in industries undergoing rapid technological and organisational change, where even short absences can lead to a perceived disadvantage compared with continuously present colleagues (Virtanen et al., 2006; Markussen, 2012).

Furthermore, sickness absence may shape employer perceptions. Employees with higher absence rates can be viewed as less reliable or productive, which may influence decisions regarding promotions, training investments, or job retention (Griep et al., 2021). In line with COR theory, this perceived resource loss can trigger further losses, reinforcing job insecurity over time (Hobfoll, 1989). While previous studies have examined the reciprocal relationship between sickness absence and job insecurity (e.g., Griep et al., 2021), our study focuses on sickness absence as the initiating factor in the resource depletion process.

Building on these insights, we argue that sickness absence can trigger a pathway to job insecurity by disrupting work continuity. This aligns with COR theory's concept of loss spirals, wherein an initial resource depletion—such as sickness absence—may increase employees' vulnerability to further resource losses, including job insecurity.

This leads to the following hypothesis:

Hypothesis 1: Sickness absence is positively related over time to job insecurity.

5.2.4 Skills obsolescence as mediator

According to COR theory, resource loss is particularly impactful because it initiates a spiral effect: once employees perceive resource depletion, they may struggle to regain lost resources, leading to further losses (Hobfoll, 1989). Skills obsolescence –defined as the process by which previously acquired skills become outdated or decline in effectiveness– is a key form of resource depletion that can be accelerated by sickness absence (De Grip & Van Loo, 2002). During their sickness absence, restricted access to workplace learning and technological advancements may further impede individuals' ability to restore their resources upon return (Görlich & De Grip, 2009), leading to skills obsolescence. Consequently, employees who perceive their skills as obsolete may further perceive heightened job insecurity, including an increased risk of redundancy or diminished career opportunities (see e.g., McGuinness et al., 2021). This aligns with COR theory's principle that employees with fewer resources become increasingly vulnerable to additional resource loss, reinforcing a self-perpetuating cycle of stress and insecurity (Hobfoll, 1989). In this way, skills obsolescence serves as a critical mechanism linking sickness absence to job insecurity, further amplifying the loss spiral outlined in COR theory. We here distinguish between two forms of skills obsolescence: technical and economic skills obsolescence.

Technical skills obsolescence

Technical skills obsolescence refers to the deterioration of skills due to wear and atrophy (Allen & De Grip, 2012; Van Loo et al., 2001). Wear is associated with ageing or physically demanding job conditions, while atrophy occurs when skills are not used for extended periods, such as during unemployment or career interruptions (Apergis & Apergis, 2020; Görlich & De Grip, 2009; Van Loo et al., 2001). Factors like physical demands, illness, and sickness absence are often associated with technical skills obsolescence (see e.g., Antczak & Miszczyńska, 2021; Van Loo et al., 2001). Research has also shown connections between physical workload, disability, and illness with increased sickness absence (Bakker et al., 2003; Kocakulah et al., 2016; Van der Burg et al., 2020).

In line with COR theory, we expect that when employees' skills deteriorate during sickness absence, a depletion of resources will be present, making them more vulnerable to further resource losses, including increased job insecurity. This aligns with previous findings that long-term unemployment exacerbates

technical obsolescence and diminishes reemployment chances (Apergis & Apergis, 2020). While sickness absence differs from unemployment, the interruption from work continuity can similarly result in skill deterioration, increasing job insecurity.

This leads to the following hypothesis:

Hypothesis 2: Technical skills obsolescence mediates the relationship between sickness absence and job insecurity over time, such that sickness absence duration increases technical skills obsolescence, which, in turn, increases job insecurity.

Economic skills obsolescence

Economic skills obsolescence occurs when employees' previously acquired skills become outdated due to technological or organisational changes (Allen & De Grip, 2012; Jones et al., 2004; Joseph & Kuan Koh, 2011; McGuinness et al., 2021). Prior studies have identified relationships between economic skills obsolescence and sickness absence (Tsai et al., 2007; see Chapter 3 and 4). However, employees returning from sickness absence may also perceive their skills as outdated due to missed technological advancements, workplace learnings or evolving job requirements and industry shifts (Allen & De Grip, 2012; Görlich & De Grip, 2009; McGuinness et al., 2021).

Previous research has established a relationship between economic skills obsolescence and job insecurity (Alcover et al., 2021; McGuinness et al., 2021). McGuinness et al. (2021) found that employees who perceived their skills as outdated reported greater job insecurity. Conversely, Allen & De Grip (2012) did not find this relationship, suggesting that accessible learning opportunities may buffer against economic skills obsolescence. This aligns with findings from Van Hootegeem et al. (2023a), who emphasise that limited learning opportunities further deplete employees' resources, reinforcing the resource loss spiral described in COR theory. Based on these insights, we expect that sickness absence increases employees' vulnerability to economic skills obsolescence and job insecurity upon their return.

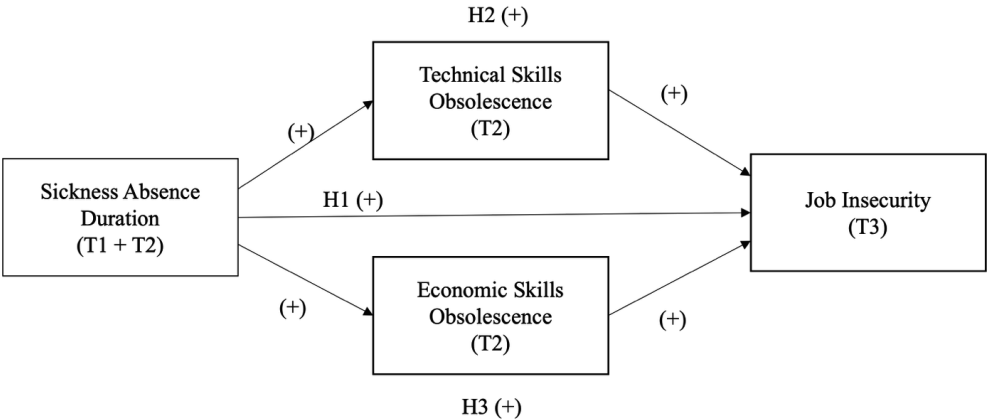
This leads to the following hypothesis:

Hypothesis 3: Economic skills obsolescence mediates the relationship between sickness absence and job insecurity over time, such that sickness absence

duration increases economic skills obsolescence, which, in turn, increases job insecurity.

Figure 5.1 gives an overview of the hypothesised relations between sickness absence, skills obsolescence, and job insecurity.

Figure 5.1 Hypothesised model of relations between sickness absence, skills obsolescence and job insecurity



Notes. T= time. H = hypothesis, direction of relation is indicated in parentheses (+) or (-).

5.3 Method

5.3.1 Participants and procedure

This study uses longitudinal survey data collected among 2,731 employees of a Dutch telecommunications organisation. The company employs about 7,000 employees. The invited employees worked in a business unit, which included customer contact centres, a department with installation and maintenance technicians, and some technical and support departments. Also, employees who were on sick leave or who were in the process of returning to work were invited to participate. However, we cannot confirm their participation as this was anonymous and we did not differentiate between absent and non-absent employees in our data collection.

Data were collected at three waves, each separated by a six-month interval, over a one-year period (September 2021 to September 2022). At each wave, employees received an e-mail invitation containing a link to an online questionnaire via Qualtrics. Prior to participation, respondents were informed about the

purpose and content of the study, confidentiality was guaranteed, and informed consent was obtained. We used short scales or single items to ensure a reasonable survey length while reducing participants' fatigue (Ohly et al., 2010).

At the first measurement (Time 1; T1), 1,444 employees participated (response rate 52%). Six months later, 750 employees completed the second survey (Time 2; T2; response rate 27%), and 665 employees participated in the third survey (Time 3; T3; response rate 24%). The final sample consisted of 490 employees who participated in all three waves of the survey.

To assess selective attrition, respondents who completed all three waves were compared with those who dropped out after T1 or T2. A binary logistic regression analysis was conducted in which attrition (0 = participated in all waves, 1 = dropped out) was regressed on demographic variables (age, gender, education), work characteristics (contract type, organisational tenure, job tenure), and study variables. Attrition analyses indicated that younger employees ($B = -.04$, $p < .001$) and employees with shorter organisational tenure ($B = -.05$, $p = .01$) were more likely to drop out. No significant differences were found for the other variables.

The final sample included employees working in customer contact centres (34.5%), installation and maintenance technicians (22.4%), managers (14.3%), staff positions such as HR and administrative roles (13.3%), and other functions including engineers, project managers, and traffic specialists (15.5%).

5.3.2 Measures

Sickness absence was measured as absence duration. Duration-based measures capture the cumulative time spent away from work due to health-related reasons and are commonly used to assess exposure to prolonged sickness absence. At Time 1, a 12-month reference period was used to assess sickness absence duration. It was measured with two questions: "Have you been absent from work due to illness in the past 12 months?" (yes/no) and, if yes, "How many days have you been absent from work during the past year (due to illness, accident, or other health reasons)?" Respondents who answered "no" were coded as 0.

At Time 2, sickness absence duration was measured using a six-month reference period to correspond with the interval between measurement waves. Respondents were asked: "How many days have you been absent from work during the past six months (due to illness, accident, or other health reasons)?"

Skills obsolescence was measured on the typology developed by De Grip and Van Loo (2002), distinguishing between *economic* and *technical* skills obsolescence.

Economic skills obsolescence was measured using five items derived from Sanders and Kraan (2013). Respondents indicated the extent to which their knowledge and skills had become less relevant due to technological and organisational changes. Items were rated on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Cronbach's $\alpha = .80$. The five items were:

- Tasks I am good at are becoming less important.
- Technological developments make much of my knowledge and skills outdated.
- Much of my knowledge and skills are no longer valued by the organisation.
- My type of work is becoming less common in organisations.
- I lack 'new' knowledge and skills that have become important due to changes in my work.

Technical skills obsolescence was measured with three items capturing declines in physical and mental capacities relevant to job performance. Items were rated on the same five-point Likert scale. Cronbach's $\alpha = .81$. The three items were:

- There are important physical aspects in my job that I cannot handle as well as before.
- There are important mental aspects in my job that I cannot handle as well as before.
- Important skills for my work that I used to master have declined.

Job insecurity was measured with a single item applied in previous research (e.g., McGuinness et al., 2021; Eurofound, 2023): "How likely do you think it is that you will lose your job in the next six months (because of reorganisation, dismissal, or non-renewal of contract)?" Responses were provided on a five-point Likert scale, with higher scores indicating higher perceived job insecurity. This six-month timeframe offers a relevant period for assessing job insecurity and for considering job-related changes, particularly in industries undergoing regular technological and organisational change.

Control variables included age (in years), gender (male, female, non-binary), education (primary, secondary, vocational, higher professional, academic), organisational tenure (years), job tenure (years), and contract type (temporary vs. permanent). Gender was dummy-coded (1 = male, 0 = female and non-binary), education was dummy-coded (1 = higher professional or academic education, 0

= lower or intermediate education), and contract type was coded as 1 for permanent contracts and 0 for temporary contracts.

5.3.3 Statistical analysis

We first assessed the reliability of the multi-item measures and computed descriptive statistics, including skewness and kurtosis, to evaluate the distributions of the study variables. Except for sickness absence duration, which showed high kurtosis, the variables displayed acceptable distributional properties. Elevated kurtosis is a well-documented characteristic of sickness absence data and reflects the highly skewed nature of absence duration, with many employees reporting no or few absence days and a small proportion reporting long absence spells (De Winter et al., 2016). To account for this distributional pattern, we computed Spearman rank-order correlations, which are less sensitive to non-normality and outliers than Pearson correlations.

Sickness absence – measured at Time 1 and Time 2 – was aggregated into a single indicator, with both measures referring to periods preceding the assessment of skills obsolescence at Time 2. Job insecurity was measured at Time 3. Aggregating sickness absence across Time 1 and Time 2 resulted in a composite measure reflecting sickness absence over a period of approximately 1.5 years. This aggregation was used to obtain a more stable and representative indicator of sickness absence and to enhance the reliability of the analyses (Harrison & Martocchio, 1998). In addition, aggregation increased the variance in sickness absence and reduced the temporal distance between sickness absence and skills obsolescence. This analytical strategy allowed us to examine longitudinal associations while explicitly accounting for the time lag between the predictor, mediator, and outcome variables.

To test the hypothesised mediation model, we used Hayes' PROCESS macro (Model 4) implemented in Stata 17 (Hayes, 2017). Indirect effects were estimated using bootstrapping procedures, based on a full mediation model that included all control variables. Effects were considered statistically significant when the 95% confidence intervals did not include zero. All analyses included the control variables gender, age, organisation and job tenure, contract type and educational level. For the direct paths in the model, results are reported as standardised coefficients (β). In line with common statistical practice in mediation analysis, the term 'effects' is used to refer to the estimated associations derived from the model parameters and does not imply causal relationships (Preacher & Hayes, 2008).

5.4 Results

5.4.1 Descriptive statistics and Spearman correlations

Respondents' ages range from 21 to 66 years ($M = 45.47$, $SD = 10.24$). Of the sample, 32% identify as female, 67% as male, and 0.2% as non-binary. The average organisational tenure is 13.70 years ($SD = 8.59$), and the average job tenure is 6.98 years ($SD = 6.49$). Educational attainment is distributed across lower (15%), intermediate (54%), and higher education levels (31%). Categorical variables are dummy-coded as described in the Method section.

Mean scores for the main study variables are as follows: economic skills obsolescence ($M = 2.30$, $SD = 0.63$), technical skills obsolescence ($M = 2.19$, $SD = 0.91$), and job insecurity ($M = 2.44$, $SD = 1.15$). The aggregated sickness absence measure has a mean of 18.54 days ($SD = 48.89$) and shows a highly skewed distribution (skew = 4.75).

Table 5.1 presents the Spearman correlations. Sickness absence is positively correlated with technical skills obsolescence ($r_s = .26$, $p < .001$) and economic skills obsolescence ($r_s = .12$, $p < .001$). Both economic skills obsolescence ($r_s = .32$, $p < .001$) and technical skills obsolescence ($r_s = .10$, $p < .05$) are positively correlated with job insecurity. However, the correlation between sickness absence and job insecurity is not significant. Technical and economic skills obsolescence are strongly correlated ($r_s = .53$, $p < .001$).

Regarding the control variables, age is positively correlated with technical skills obsolescence ($r_s = .25$, $p < .001$), economic skills obsolescence ($r_s = .17$, $p < .001$), and job insecurity ($r_s = .15$, $p < .001$). Organisational tenure and job tenure are positively correlated with technical skills obsolescence ($r_s = .24$, $p < .001$ and $r_s = .27$, $p < .001$, respectively) and with economic skills obsolescence ($r_s = .23$, $p < .001$ and $r_s = .21$, $p < .001$, respectively). Organisational tenure is significantly correlated with job insecurity ($r_s = .10$, $p < .05$).

Table 5.1 Spearman correlations

	1	2	3	4	5	6	7	8	9
1. Sickness absence									
2. Economic obsolescence	.12**								
3. Technical obsolescence	.26**	.53**							
4. Job insecurity	-.07	.32**	.10*						
5. Age	-.14**	.17**	.25**	.15**					
6. Education ^a	-.17**	-.14**	-.21**	.00	-.08				
7. Gender ^b	-.01	.00	.10*	-.04	.09*	-.03			
8. Organisation tenure	-.11**	.23**	.24**	.10*	.57**	-.16**	-.12**		
9. Job tenure	.04	.21**	.27**	.00	.39**	-.15**	-.17**	.57**	
10. Contract type ^c	-.07	.17**	.10*	-.00	.24**	.04	-.04	-.41**	.36**

Notes. $n = 489$. * $p < .05$. ** $p < .01$. ^aGender is coded as 1 for male and 0 for female and non-binary. ^bEducation is coded as 1 for higher education and 0 for lower and middle education. ^cContract type is coded as 1 for fixed contracts and 0 for temporary contracts.

5.4.2 Hypotheses testing

Table 5.2 presents the parallel mediation results of the hypothesised model. The model is significant ($p < .001$), and the independent variables explain 13% of the variance in job insecurity.

Hypothesis 1 states that there is a direct relationship between sickness absence and job insecurity. The results do not show a significant direct relationship between sickness absence and job insecurity. Therefore, Hypothesis 1 is not supported.

Hypothesis 2 predicts that the relationship between sickness absence and job insecurity is mediated by technical skills obsolescence, such that absence duration increases technical skills obsolescence, which, in turn, increases job insecurity. The results show a significant positive relationship between sickness absence and technical skills obsolescence ($\beta = .19, p < .001$). However, technical skills obsolescence is not significantly related to job insecurity, and the indirect relationship between sickness absence and job insecurity, via technical skills obsolescence is also not significant. Therefore, Hypothesis 2 is not supported.

Hypothesis 3 predicts that the relationship between sickness absence and job insecurity is mediated by economic skills obsolescence, such that absence duration increases economic skills obsolescence, which, in turn, increases job insecurity. The results show significant positive relationships between sickness absence and economic skills obsolescence ($\beta = .10, p < .001$) and between

economic skills obsolescence and job insecurity ($\beta = .35, p < .001$). Consistent with these results, there is a significant indirect relationship between sickness absence and job insecurity via economic skills obsolescence ($\beta = .07, p < .001$), supporting Hypothesis 3.

Together, these outcomes indicate that the relationship between sickness absence and job insecurity is fully mediated by economic skills obsolescence.

Table 5.2 (In)direct effects of sickness absence on job insecurity via technical and economic skills obsolescence

	Economic skills obsolescence (ESO)		Technical skills obsolescence (TSO)		Job Insecurity	
	β	SE	β	SE	β	SE
Sickness absence	.10**	.01	.19**	.01	-.01	.02
ESO					.35**	.09
TSO					-.08	.07
Age	.06	.00	.12**	.01	.19**	.01
Gender ^a	-.05	.06	.10	.08	-.03	.10
Education ^b	-.11**	.06	-.10**	.08	.05	.10
Organisation tenure	.10	.00	-.02	.01	-.02	.01
Job tenure	.05	.00	.18**	.01	-.10*	.01
Contract type ^c	-.12**	.11	.07	.16	.04	.21
Bootstrap indirect effects of sickness absence on job insecurity via skills obsolescence						
	β	SE	95% CI			
ESO	.07**	.02	.01, .09			
TSO	-.02	.01	-.04, .01			

Notes. $n = 489$. * $p < .05$. ** $p < .01$. Standardised regression coefficients are reported. Bootstrap sample size = 1,000. ^aGender is coded as 1 for male and 0 for female and non-binary. ^bEducation is coded as 1 for higher education and 0 for lower and middle education.

^cContract type is coded as 1 for fixed contracts and 0 for temporary contracts.

ESO = economic skills obsolescence. TSO = technical skills obsolescence.

5.5 Discussion

We used longitudinal data from 490 employees aged 21–66 at a Dutch telecom company to examine the relationship between sickness absence and job insecurity over time. We expected that this process would occur through the distinct pathways of skills obsolescence. First, the results do not reveal a significant direct relationship between sickness absence and job insecurity. This contrasts with findings reported by Griep et al. (2021) but is consistent with earlier studies that also report a non-significant direct association (Ishimaru, 2020; Kim et al.,

2020). Several contextual factors may explain this outcome, including the longer time lag between the measurement of sickness absence and job insecurity in our study. This temporal distance may allow other work-related developments or contextual changes to shape employees' perceptions, thereby attenuating a direct association between sickness absence and subsequent job insecurity.

In addition, only 17% of employees in our sample report a high probability of job loss within the next six months, which is substantially lower than the national average of 24% (Eurofound, 2023). The high proportion of employees with permanent contracts in our sample likely contributes to this difference. Dutch labour law prohibits dismissal during the first two years of sickness absence, which may provide additional employment security for employees experiencing health-related absence. Consistent with this, earlier research shows that permanent employment protects employees against unemployment even when sickness absence levels are high (Virtanen et al., 2006). This institutional context may partly explain why sickness absence is not directly associated with higher job insecurity in the present study.

Second, contrary to our expectations, technical skills obsolescence did not mediate the relationship between sickness absence and job insecurity. Several factors may account for this non-significant finding. The recovery effect of being absent from work may counterbalance the effect of technical skills obsolescence on job insecurity. Employees often return with renewed physical and mental capacities, which mitigate skill deterioration during their sickness absence. Sonnentag et al. (2017) demonstrated that time away from work demands is essential for recovery, allowing employees to replenish depleted physical and mental resources. As a result, employees may return with restored energy and cognitive function, reducing the impact of technical skills obsolescence caused by sickness absence.

Another explanation may be found in Selection, Optimisation and Compensation (SOC) theory (Baltes & Baltes, 1990). Our results revealed a stronger relationship between older age and technical skills obsolescence. However, older employees often employ adaptive strategies to remain relevant and effective despite potential declines in physical and cognitive capacities. SOC theory outlines three vital strategies: selection, which involves choosing tasks that align with retained skills; optimisation, which refers to enhancing performance through targeted training or practice; and compensation, which includes using new strategies or technologies to offset skills obsolescence. While we did not explicitly test SOC mechanisms, these adaptive strategies may help employees mitigate the impact of technical skills obsolescence, maintaining their effectiveness despite

certain declines. In knowledge-based industries, employees may have greater access to learning opportunities and technological support, which could buffer against skill deterioration during sickness absence. However, in industries where adaptive strategies are less feasible, such as physically demanding jobs, the consequences of technical skills obsolescence may be more severe, as deterioration due to ageing, illness, or prolonged non-use is harder to compensate for through training or technological assistance.

Finally, we found a significant mediating effect of economic skills obsolescence. Our results showed that sickness absence is associated with higher perceptions of economic skills obsolescence, which, in turn, increase job insecurity. Despite protective legislation that prevents dismissals during sickness absence, employees may still believe their jobs are at risk if they perceive economic skills obsolescence. This significant mediating effect aligns with COR theory, which posits that stress emerges from threats to, or actual losses of, valuable resources (Hobfoll, 1989). Sickness absence can contribute to such perceived obsolescence, as absent employees may feel they are missing crucial opportunities to maintain or acquire necessary skills, thereby increasing their job insecurity. Van Hootegeem et al. (2023b) also highlighted that a lack of training opportunities and perceived job insecurity constitute significant threats to employees' resources. By viewing sickness absence as a disruption that depletes employees' resources—particularly their skill sets—our findings reinforce COR theory's emphasis on resource loss spirals.

Moreover, our results indicate a high correlation between economic and technical skills obsolescence, with economic skills obsolescence showing a stronger relationship with job insecurity. While employees may perceive some degree of technical skills obsolescence following sickness absence, it is economic skills obsolescence that primarily underpins the link between sickness absence and job insecurity. Economic skills obsolescence arises when technological and organisational changes render previously acquired skills obsolete, necessitating continuous skills adaptation (Allen & De Grip, 2012). By contrast, technical skills obsolescence stems from internal factors such as ageing, illness, or prolonged skill non-use.

Given the telecom sector's rapid technological advancements, employees in this industry are particularly susceptible to economic skills obsolescence (Lovász & Rigó, 2013). This is especially relevant for roles requiring frequent technological adaptation, such as technicians, call centre agents, and engineers, who together constitute a substantial share of our sample. Many of these roles require ongoing familiarity with evolving tools, systems, and industry developments.

Sickness absence disrupts this exposure, increasing the risk that returning employees perceive their skills as outdated, thereby heightening job insecurity. These findings underscore the importance of addressing sickness absence as more than a temporary interruption, but rather as a process that may accelerate skills obsolescence in dynamic work environments.

5.5.1 Limitations and future research

While our study provides valuable insights into the consequences of sickness absence, it has some limitations that future research could address. A primary limitation is the use of a single-item measure for cognitive job insecurity. While this approach is widely recognised and utilised (see, e.g., Eurofound, 2023; McGuinness et al., 2021), it does not capture the multidimensional nature of job insecurity, which generally includes both cognitive and affective components.

Additionally, our job insecurity measurement only covered a six-month period, as this reflects a timeframe relevant to industries undergoing technological and organisational changes. However, a more nuanced and extended measurement period might offer a more comprehensive understanding of the differential effects on both components of job insecurity. This would provide a more in-depth analysis of the psychological impacts of sickness absence and skills obsolescence on job insecurity. While our findings indicate an indirect relationship between sickness absence and job insecurity via economic skills obsolescence, the single-time-point measurement of job insecurity limits our ability to assess how perceptions change over time. As Cole and Maxwell (2003) argue, repeated measurement of the outcome variable strengthens mediation claims by capturing temporal dynamics. Future research could build on our findings by including multiple measurement points for job insecurity to more robustly examine how such perceptions develop following absence.

Another limitation is the decision not to distinguish between short-term and long-term sickness absence due to the lack of a consistent threshold in the literature. In fast-changing industries, even short absences may contribute to skills obsolescence, making this distinction less relevant. Additionally, sickness absence data typically exhibit a bimodal distribution, with a large proportion of employees never taking sick leave and a smaller group experiencing longer absence periods. Given this, creating separate categories within our sample would have resulted in small and uneven subsamples, potentially reducing the reliability of subgroup analyses. While our total sample size ($N = 490$) was sufficient for the primary analyses, subgroup comparisons were more constrained. To account for this, we treated sickness absence as a continuous variable, align-

ing with the concept of a continuum process. This approach is consistent with COR theory, which conceptualises resource depletion as a gradual rather than abrupt process (Hobfoll, 1989).

Although our sickness absence data reduced the issue of a long gap between T1 and T2 measurements, the distribution remains skewed. However, this skewness is unlikely to compromise the validity of our findings, as we applied the PROCESS macro (Hayes, 2017) with bootstrapping techniques, ensuring the robustness of the results. Future research could benefit from larger and more balanced datasets to explore alternative ways to operationalise sickness absence, particularly in industries with less technological disruption or in studies that aim to examine subgroup effects in greater detail.

A final limitation arises from our data collection, which is confined to a Dutch company. This raises questions about the generalisability of our findings. However, our study suggests that Dutch legal protections mitigate the direct impact of sickness absence on job insecurity, which aligns with Virtanen et al. (2006) and highlights the importance of considering contextual factors in research on job insecurity. While our study focuses on skills obsolescence as a mediating mechanism, other pathways may also contribute to the relationship between sickness absence and job insecurity, and their influence may vary across institutional and organisational contexts. Future research could involve diverse samples from various national and organisational contexts to enhance the generalisability of findings. Comparative analyses across countries with different social security systems would provide a broader understanding of how contextual factors influence the relationship between sickness absence, skills obsolescence, and job insecurity.

5.5.2 Practical implications

Our findings highlight the importance of structured return-to-work policies to help employees maintain their job security and employability after sickness absence, particularly in industries undergoing rapid technological change. Given the role of economic skills obsolescence in the relationship between sickness absence and job insecurity, organisations should prioritise continuous learning opportunities that ensure employees remain up to date with technological and organisational developments. First, clear return-to-work activities can help employees regain their professional footing. This includes structured updates on workplace changes, access to targeted training opportunities, and mentorship to facilitate knowledge transfer. Ensuring that employees stay informed about

evolving job requirements may help reduce uncertainty and concerns about job stability.

Second, a learning-oriented work environment is crucial for mitigating skills obsolescence and supporting long-term employability. While our study did not directly test learning processes or training effects, previous research suggests that access to learning opportunities can buffer against skill obsolescence and mitigate perceptions of job insecurity (Van Hooft et al., 2023a). Organisations should therefore offer accessible and flexible learning opportunities—such as on-the-job training, exposure to new tools and systems, and digital learning platforms—to allow employees to maintain and update their skills while returning from sickness absence. Although our findings did not indicate a significant mediating effect of technical skills obsolescence, organisations should be mindful that employees in physically demanding jobs may perceive skill deterioration due to sickness absence. Supporting their return-to-work process may require additional training, gradual reintroduction, or specific workplace adjustments.

Third, the social and organisational aspects of returning to work should not be overlooked. Employees who have been absent may risk being sidelined or perceived as less capable, which could reinforce job insecurity. To counter this, managers play a key role in ensuring that returning employees remain included into workplace activities and career development processes. Finally, return-to-work strategies should be a shared responsibility between employers and employees, ensuring that employees receive adequate support while maintaining opportunities for professional growth. By providing structured learning opportunities, facilitating knowledge-sharing, and ensuring clear return-to-work processes, organisations can help employees navigate job demands more effectively, reducing the risk of skills obsolescence and job insecurity.

5.6 Conclusion

Our study, conducted at a Dutch telecom organisation, highlights the relationship between sickness absence, skills obsolescence, and job insecurity. The findings reveal that economic skills obsolescence—an externally driven process in which employees' skills lose value due to evolving job requirements in the labour market—is significantly associated with job insecurity. In contrast, we found no significant relationship via technical skills obsolescence, which refers to the decline of skills due to disuse, ageing, illness, or injury. These results indicate that in industries where technological advances frequently alter job requirements, economic skills obsolescence serves as the primary mechanism

linking sickness absence to job insecurity. Employees returning from sickness absence are especially vulnerable, as they may struggle to keep pace with these evolving demands. The perceived loss of value of their skills in relation to changing job requirements can increase job insecurity, making employees feel less competent and more vulnerable to potential job loss.

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6

Conclusions and discussion

6.1 Summary of the empirical findings

Following De Grip and Van Loo (2002), a distinction is made between *economic* and *technical* skills obsolescence. Economic skills obsolescence refers to the depreciation of employees' skills due to technological and organisational changes in the workplace that alter the skill requirements in their job. It reflects employees' perceptions that previously relevant skills no longer adequately support them in their job. Technical skills obsolescence refers to declines in physical, mental or task-related capacities, for example due to ageing, non-use, illness or injury.

The four empirical chapters of this dissertation examine economic skills obsolescence from complementary perspectives, focusing on how employees perceive the consequences of skills obsolescence and how they respond to it. Perceived economic skills obsolescence emerges throughout the empirical findings as a mechanism through which workplace change affects employees' motivation, health and work participation. Anchored in human capital theory, skills lose value when work content and the skills required in the job evolve (Becker, 1964; Mincer, 1974).

The findings suggest that the consequences of this depreciation do not only depend on the changes in skill requirements themselves, but also on how employees perceive and respond to these changes within their work environment. It is particularly this *perceived* economic skills obsolescence that can explain how this obsolescence associates with employees' learning, work engagement, burnout, sickness absence and job insecurity, consistent with social-cognitive perspectives on learning and performance (Bandura, 1997).

Across the four empirical studies in this dissertation, a common pattern emerges. Perceived economic skills obsolescence is best understood as a dynamic process that develops in response to changing job requirements, employees' access to resources, and continued participation in work. Rather than representing a fixed mismatch between employees' skills and job requirements, it reflects employees' perceptions that the value of their skills is declining in a changing work environment. These perceptions are associated with employees' motivation, health, employability, and continued participation in work .

Chapter 2 examines how perceived economic skills obsolescence relates to employees' perceptions of development opportunities at work and the extent to which this relationship is explained by psychological resources. Drawing on Conservation of Resources theory (Hobfoll, 1989), perceived economic skills

obsolescence is positioned as a form of resource loss that reflects employees' perception of skill obsolescence in changing work contexts. When employees perceive that their skills no longer match evolving job requirements, they are less likely to view their work as offering opportunities for development.

The findings show that employees who perceive higher economic skills obsolescence report lower learning attitudes and lower mastery, which in turn relate to fewer perceived development opportunities at work. This pattern indicates that perceived economic skills obsolescence affects how employees evaluate the learning potential of their job through its impact on learning-related psychological resources, particularly learning attitude and mastery. Learning efficacy shows a different pattern. Although it is negatively related to perceived economic skills obsolescence, it does not translate into perceiving more development opportunities embedded in the job. This suggests there is a distinction between general confidence in one's learning capability and evaluations of context-specific learning conditions at work.

The results further show that these psychological pathways differ by age. Older employees perceive stronger reductions in learning attitude and learning efficacy when they perceive economic skills obsolescence than younger employees do, whereas mastery shows a more stable relationship across age groups. Importantly, these age differences in psychological resources do not result in stronger age differences in perceived development opportunities. These findings indicate that perceived economic skills obsolescence shapes the psychological resources employees rely on when evaluating development opportunities, while the consequences of this process differ across age groups.

This chapter highlights the psychological pathways through which perceived economic skills obsolescence shapes evaluations of development opportunities and shows that age differentiates these resource dynamics without amplifying the overall association with development opportunities.

Chapter 3 examines whether economic skills obsolescence functions as a work-related stressor that contributes to sickness absence among older employees and explores the processes through which this relationship unfolds. The findings show that older employees who perceive higher levels of economic skills obsolescence report higher burnout and lower work engagement over time, and that these changes explain why they subsequently report sickness absence more frequently and for longer durations.

Burnout and work engagement mediate the relationship between perceived economic skills obsolescence and both sickness absence frequency and duration. This pattern reflects interconnected health-impairment and motivational pathways as described in the Job Demands–Resources (JD–R) model (Bakker & Demerouti, 2007) and is consistent with Conservation of Resources (COR) theory (Hobfoll, 2001). Perceived economic skills obsolescence erodes employees' resources needed to cope with changing demands, increasing the likelihood of health-related withdrawal from work. The findings further show that falling behind in a changing work environment sustains pressure on older employees, who often have fewer opportunities to restore resources through training or job mobility. As skill-related resources continue to erode, sickness absence becomes more likely, increasing the risk of longer-term withdrawal from work and, over time, possibly contributing to early labour market detachment.

Chapter 4 examines perceived economic skills obsolescence and development opportunities at work through the JD–R framework (Bakker & Demerouti, 2007). Within this framework, perceived economic skills obsolescence functions as a job stressor that increases strain, whereas development opportunities operate as a core job resource that supports motivation and continued participation at work.

The findings show that employees who perceive their skills as outdated report lower work engagement and report sickness absence more frequently. Development opportunities emerge as a central resource. Employees who perceive that their job offers opportunities for development report lower perceived economic skills obsolescence, higher work engagement and fewer sickness absence episodes. These findings show that learning-rich work environments support employees in interpreting changing skill demands as manageable, thereby sustaining both their motivation and attendance at work.

The results further show that employees at different stages of their working life tend to report different types of skills as becoming obsolete. Older employees more often report obsolescence of technical and ICT-related skills, whereas younger employees more often report obsolescence of social or analytical skills within the broader construct of perceived economic skills obsolescence. These findings suggest that perceived economic skills obsolescence reflects exposure to changing task demands across the life course rather than age per se. This chapter underscores the role of development opportunities in shaping how employees perceive changing skill requirements and participate in work.

Chapter 5 demonstrates that sickness absence may itself contribute to perceived economic skills obsolescence and subsequent job insecurity. The findings show that employees returning after longer periods of sickness absence are more likely to perceive economic skills obsolescence, as changes in work processes and systems may reduce the perceived value of their existing skills, which is associated with higher job insecurity. Technical skills obsolescence does not explain this relationship. Instead, prolonged sickness absence disrupts employees' exposure to evolving job content and accelerates resource loss through perceived economic skills obsolescence.

These findings suggest that sickness absence is not only a health-related interruption but also a disruption of employees' continued engagement with workplace developments. As employees' skill development and maintenance largely occur through daily task execution, informal learning and continued exposure to changing work processes, time away from work reduces their opportunities to prevent economic skills obsolescence. As a result, prolonged sickness absence can intensify their perceptions of economic skills obsolescence and contribute to job insecurity upon return to work.

The findings further show that this pattern is most pronounced among employees with lower educational levels, suggesting that employees with fewer formal qualifications are particularly vulnerable to perceiving absence as a loss of relevance or competitiveness. Technical skills obsolescence, although conceptually relevant and reflected in reports of reduced physical, mental or task-specific capability, explains less variance in job insecurity once perceived economic skills obsolescence is taken into account. Given the strong association between economic and technical skills obsolescence, the findings suggest that economic skills obsolescence plays a more prominent role in explaining job insecurity. In organisational contexts characterised by ongoing technological and procedural change, sickness absence may increase employees' perceptions that their skills have become less valuable, which in turn relates to concerns about employment.

By linking sickness absence, perceived economic skills obsolescence and job insecurity, this chapter shows that skills obsolescence may arise not only when work evolves faster than employees can adapt, but also when employees temporarily disengage from ongoing workplace developments, thereby reinforcing resource loss processes that undermine continued participation in work.

Although the empirical chapters of this dissertation examine different outcomes and contexts, the findings collectively suggest that perceived economic

skills obsolescence is embedded in dynamic and context-dependent processes rather than a single linear pathway.

Chapter 2 shows that perceived economic skills obsolescence is associated with fewer perceived development opportunities through reduced psychological resources, whereas Chapter 4 suggests that development opportunities may simultaneously help reduce perceptions of economic skills obsolescence. Similarly, Chapters 3 and 5 indicate that perceived economic skills obsolescence and sickness absence may reinforce one another over time. Higher perceived economic skills obsolescence is associated with burnout, lower work engagement and subsequent sickness absence, while prolonged sickness absence may reduce exposure to workplace developments and contribute to increasing perceptions of skills obsolescence.

Taken together, these findings suggest that perceived economic skills obsolescence is not merely an outcome of changing job requirements, but part of an ongoing process in which employees' resources, development opportunities and work participation continuously influence one another. This highlights the importance of understanding economic skills obsolescence as a dynamic phenomenon that both shapes and is shaped by employees' experiences within changing work environments.

6.2 General Conclusions

Changing work environments require employees to continuously maintain their skills valuable for their job. The findings presented in this dissertation suggest that economic skills obsolescence is not solely a consequence of technological or organisational change as such but also reflects how employees view their ability to keep pace with these developments. Perceived economic skills obsolescence therefore represents more than a discrepancy between employees' skills and job requirements. It reflects an ongoing process through which employees evaluate whether their existing skills remain valuable within evolving work contexts. Importantly, this does not imply that subjective perceptions diverge from actual skills obsolescence, but rather that perceived economic skills obsolescence captures how changes in skill requirements affect the behaviour of employees at work.

Across the four empirical chapters, these perceptions are associated with employees' learning-related resources, work engagement, burnout, sickness absence and job insecurity. Together, these findings suggest that perceived

economic skills obsolescence functions as a central mechanism through which employees interpret and respond to changing job requirements.

The findings contribute to the literature by clarifying how perceived economic skills obsolescence can be understood within complementary theoretical frameworks. This dissertation integrates the Job Demands–Resources (JD–R) model (Demerouti et al., 2001; Bakker & Demerouti, 2007) and Conservation of Resources (COR) theory (Hobfoll, 1989) to explain how economic skills obsolescence relates to engagement, health and continued work participation through employees' perceptions.

Within the JD–R framework, perceived economic skills obsolescence may be understood as a demand-related stressor that arises when employees perceive difficulty maintaining the relevance of their skills in response to changing job requirements. This positioning extends the JD–R perspective by recognising that job demands are not experienced identically across employees. The consequences of changing job requirements may depend on how employees interpret these changes and perceive their ability to adapt to them. Perceived economic skills obsolescence therefore reflects more than exposure to workplace change itself. Rather, it captures employees' perceptions that their existing skills are becoming less relevant in relation to evolving job requirements.

Second, perceived economic skills obsolescence is associated with resource-related processes, although these processes differ across the four empirical chapters. Within COR theory, it reflects a process through which employees' resource loss develops and relates to subsequent learning-related resources, sickness absence and job insecurity. In Chapter 2, employees who perceive their skills as outdated report lower learning-related psychological resources with respect to learning attitude, mastery and, in some contexts, learning efficacy. These resources help explain how perceived economic skills obsolescence relates to perceived development opportunities at work. In Chapters 3 and 4, perceived economic skills obsolescence is associated with lower work engagement, higher burnout and sickness absence. Together, these findings suggest that perceived economic skills obsolescence contributes to different forms of resource loss depending on whether the focus lies on learning, motivation, health or work participation.

Beyond these resource loss processes, the findings across chapters also suggest reciprocal and context-dependent relationships involving perceived economic skills obsolescence. Development opportunities may reduce perceptions of economic skills obsolescence by supporting adaptation and continued learn-

ing, while perceived economic skills obsolescence may simultaneously reduce employees' willingness to engage in learning activities. Similarly, perceived economic skills obsolescence may contribute to sickness absence through reduced engagement as well as increased burnout, whereas prolonged sickness absence may increase perceptions of skills obsolescence by limiting exposure to changing work practices during periods of sickness. These patterns indicate that perceived economic skills obsolescence is embedded in reciprocal and context-dependent processes.

A third conclusion is that employees' perceptions of economic skills obsolescence are closely connected to the psychological and organisational resources available within their work environment. Development opportunities at work are associated with lower perceived economic skills obsolescence and stronger work engagement. Learning-related psychological resources, work engagement, burnout and sickness absence are linked to whether employees experience skills obsolescence, while organisational opportunities for development relate to employees' capacity to remain adaptive and connected to their work. These findings suggest that perceived economic skills obsolescence should not be understood solely as an individual characteristic, but as a process that develops within the broader context of employees' work environment.

Age further shapes how employees react to perceived economic skills obsolescence. Older employees show stronger reductions in learning-related resources when they perceive skills obsolescence, indicating greater vulnerability to resource loss in changing work environments. However, these findings should not be interpreted as evidence that older employees are less capable of learning or adapting. Rather, age-related differences appear to reflect variation in opportunities, accumulated skills and work experience, organisational expectations, and perceived access to learning.

Research on ageing and work increasingly shows that while certain cognitive or task-specific capacities may change over time, accumulated skills, experience, domain-specific knowledge and contextual understanding may continue to support adaptation to changing job requirements (Baltes & Baltes, 1990; Beier & Ackerman, 2005; De Grip & Van Loo, 2002; Pazy, 1994). This suggests that perceptions of economic skills obsolescence cannot be reduced to chronological age as such, but should be understood in relation to employees' resources, work context and opportunities for continued learning.

At the same time, perceptions of economic skills obsolescence may partly reflect how employees interpret their position within their organisational con-

text. Older employees are more frequently exposed to stereotypes suggesting lower performance, reduced learning motivation and limited opportunities for development within organisations (Van Dam et al., 2017). Such stereotypes may shape how employees evaluate their own skills and future employability. In this sense, perceived economic skills obsolescence may not only reflect changing job requirements, but also how employees internalise signals from their work environment regarding age, learning and competence.

6.3 Future Research

The findings of this dissertation are shaped by several design choices that also point to directions for future research. Three of the four empirical studies draw on longitudinal data collected within a single organisation operating in a technologically dynamic sector. This focus enabled detailed examination of how skills obsolescence develops over time as job requirements evolve. In addition, the dissertation includes evidence from the STREAM dataset (TNO), covering a broad range of organisations and occupational contexts, particularly in the study of older employees (Ybema et al., 2014). These complementary data sources allow both in-depth analysis of dynamic processes within organisations and broader insight into age-related patterns. Future research could extend this approach by examining how skills obsolescence develops across organisations with different technological trajectories, institutional arrangements and learning infrastructures.

Second, in this dissertation, both economic and technical skills obsolescence were assessed using perceptual measures that capture employees' subjective perceptions of changing work demands. For economic skills obsolescence, this perceptual focus is central to the theoretical framework of this dissertation, as it captures employees' perceptions that their existing skills are no longer relevant due to changing job requirements, which relates to subsequent processes involving learning-related resources and employability-related outcomes. In contrast, the measure of technical skills obsolescence reflected perceived declines in skill proficiency and functional capacity, rather than task-level changes in required skills resulting from technological change. Future research could strengthen the conceptual distinction between economic and technical skills obsolescence by developing measures that more explicitly differentiate perceived changes in value from perceived declines in skill capacity. This may improve conceptual precision while retaining the explanatory value of employees' subjective perceptions.

Relatedly, future studies may benefit from integrating subjective and objective indicators of work change to better understand how task demands are interpreted, evaluated and acted upon within specific organisational contexts. Rather than treating objective indicators as substitutes for perceptual measures, such integrative approaches could shed light on how organisational signals, task redesign and technological implementation interact with employees' interpretations to shape perceptions of skills obsolescence and subsequent resource investment processes.

The findings of this dissertation highlight the importance of adopting a life-course perspective when studying how employees adapt to changing work environments, as the consequences of economic skills obsolescence as well as the availability of psychological and organisational resources differ across stages of the working life. Older employees in particular perceive stronger reductions in learning attitude and learning efficacy when they perceive economic skills obsolescence. At the same time, much remains unknown about how cumulative patterns of resource investment, opportunity structures and career histories shape these responses. Future research could examine development trajectories across the career span, focusing on how access to learning opportunities, organisational support and informal learning environments relate to employees' capacity to remain adaptive and employable later in their working lives.

Finally, future research that more explicitly incorporates social and organisational contexts could deepen our understanding of how perceptions of economic skills obsolescence emerge and evolve. Supervisors and teams play a key role in signalling expectations, making learning opportunities visible and shaping the climate in which task change is interpreted. Studies examining team learning norms, information flows, leadership practices and organisational communication may help explain why some employees interpret changes in skill demands as manageable, while others perceive them as threats to their competence. Integrating individual, team and organisational perspectives would provide a more comprehensive understanding of how employees remain connected, confident and capable in workplaces characterised by continual change.

Although the empirical chapters primarily examined mediating mechanisms, some findings suggest that relationships involving perceived economic skills obsolescence may vary across employees and work contexts. Future research could therefore examine contextual conditions, such as organisational support, occupational context and age-related heterogeneity, to better understand when perceived economic skills obsolescence becomes more or less consequential.

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Impact

This dissertation examines how perceived economic skills obsolescence develops in response to changing job requirements and how this process relates to employees' development, health and continued work participation. Across four empirical chapters, the findings show that perceived economic skills obsolescence is systematically related to employees' perception of development opportunities at work, psychological resources, work engagement, burnout, sickness absence and job insecurity. This dissertation contributes by demonstrating how perceived economic skills obsolescence shapes employees' psychological responses to changing job requirements and their adaptation to these changes.

Conceptual and empirical contributions

The central contribution of this dissertation is the positioning of perceived economic skills obsolescence as a mechanism through which changing work environments relate to resource loss and work-related outcomes. Drawing on Conservation of Resources (COR) theory and the Job Demands–Resources (JD–R) model, the dissertation demonstrates that perceived skills obsolescence is not merely a reflection of objective task change but also affects employees' psychological resources and behavioural responses.

Across the empirical chapters, perceived economic skills obsolescence consistently relates to lower learning attitude and mastery and, in specific contexts, learning efficacy. These learning-related resources help explain how perceived economic skills obsolescence relates to lower development opportunities at work, reduced work engagement, higher burnout and adverse employment-related outcomes, including sickness absence and job insecurity. By explicitly modelling these pathways, the dissertation advances existing research on skills obsolescence by showing how economic skills obsolescence translates into psychological and behavioural consequences at work.

A reciprocal relationship may exist between perceived economic skills obsolescence and development opportunities at work. Limited development opportunities may increase employees' perceptions that their skills lose value, while perceived economic skills obsolescence may simultaneously reduce employees' engagement in learning and development. This highlights that development opportunities are not only characteristics of the organisational context, but may also shape how employees perceive and respond to changing job requirements.

These processes appear to vary across different stages of employees' working lives and depend on the availability of resources that support learning, adaptation and continued participation at work. Older employees show stronger negative associations between perceived economic skills obsolescence and learning-related resources, suggesting greater vulnerability to resource loss when skills are perceived as losing value over time. This suggests that economic skills obsolescence may carry different implications across employees' working lives, depending on access to development opportunities, accumulated skills and perceived adaptability. Rather than reflecting age alone, these patterns indicate that differences in perceived skills obsolescence may emerge from unequal access to resources that support continued employability.

Theoretical implications for JD–R and COR theory

This dissertation refines existing theoretical perspectives by clarifying how economic skills obsolescence operates within changing work environments. Within the JD–R framework, perceived economic skills obsolescence may be understood as a dynamic demand-related experience that emerges when employees perceive that previously acquired skills no longer adequately support changing job requirements. Perceived skills obsolescence differs from traditional job demands such as workload because it specifically reflects employees' perceptions that their skills lose value in response to evolving job requirements. This means that changing skill requirements may represent a distinct form of strain linked to perceived skills obsolescence rather than task intensity alone. Employees may therefore experience stress not only because work is demanding, but also because they perceive increasing difficulty in keeping their skills valuable and aligned with changing job requirements.

From a COR perspective, perceived economic skills obsolescence may emerge through gradual resource loss processes. Learning-related psychological resources such as mastery, learning attitude and learning efficacy appear to function as mechanisms through which employees respond to economic skills obsolescence.

Taken together, the dissertation positions economic skills obsolescence as a mechanism through which changing job requirements become psychologically meaningful for employees. This contributes to a more dynamic understanding of how work environments relate to long-term participation, health and development.

Implications for work, sickness absence and return-to-work

The dissertation shows that perceived economic skills obsolescence has direct implications for employees' participation at work. Employees who perceive their skills as outdated report lower work engagement and higher levels of burnout, which explains more frequent and longer sickness absence. These findings demonstrate that economic skills obsolescence functions as a work-related stressor that affects daily functioning and health, particularly among older employees.

Sickness absence may also contribute to perceived economic skills obsolescence. Periods away from work reduce employees' exposure to task changes, informal learning and evolving work practices, increasing the likelihood that returning employees perceive that their existing skills have lost value in relation to current job requirements. This process is associated with higher economic skills obsolescence and job insecurity, which may complicate return-to-work and increase the risk of prolonged or recurrent sickness absence. Perceived economic skills obsolescence and sickness absence may reinforce one another through resource loss processes. Return-to-work after sickness absence therefore requires explicit attention to skills updating and development opportunities at work, particularly in contexts characterised by rapid technological and organisational change. Organisations often approach the skill development and sickness absence of their employees as separate domains of their HR-practices. This dissertation shows that economic skills obsolescence as well as that lack of development opportunities can be a driver of sickness absence. Recognising these mechanisms could help organisations to intervene earlier by targeted development practices to prevent economic skills obsolescence and strengthen sustainable employability across the working life of their employees.

Professional context and dissemination

My professional experience in HR reflects the processes identified in this dissertation. Employees returning to work after sickness absence are often confronted with new digital systems, reorganised teams or updated procedures that were introduced while they were away from work. Others experience pressure because the pace of organisational change exceeds the time and support available for learning. In practice, these situations frequently lead to uncertainty, reduced engagement and recurring health complaints. At the same time, organisations often lack clear insight into how skills obsolescence, development opportunities and sickness absence interact. This dissertation provides an empirically grounded framework that helps clarify these dynamics.

The relevance of this dissertation extends beyond the academic literature. The empirical chapters have been disseminated through presentations at national and international conferences, including EAWOP conferences in Katowice and Reims, as well as through presentations at a symposium on job insecurity in Leuven and a symposium related to the farewell lecture of Tinka van Vuuren in Heerlen. Furthermore, I presented my research in various organisational and professional settings. In addition, the findings were disseminated through practitioner-oriented publications and professional presentations targeting HR professionals, policymakers and organisational stakeholders. Three of the four empirical chapters have been published in peer-reviewed journals, with the fourth accepted for publication in a peer-reviewed journal and expected to appear in the summer of 2026.

Summary

This dissertation examines how employees perceive economic and technical skills obsolescence in changing work environments and how these perceptions relate to development opportunities at work, psychological resources, work engagement, burnout, sickness absence and job insecurity. Technological and organisational developments continuously reshape job tasks, workflows and required skills. As a result, employees may perceive that their skills no longer adequately support changing job requirements.

Building on the human capital literature, this dissertation distinguishes between economic and technical skills obsolescence. Economic skills obsolescence refers to the depreciation of skills due to technological and organisational change. Technical skills obsolescence reflects perceived declines in physical or mental capacities required to perform work tasks, often because of ageing, illness or prolonged non-use. The primary focus of this dissertation is on perceived economic skills obsolescence, as this form is most directly related to how employees perceive and respond to changing job requirements in contemporary workplaces. Technical skills obsolescence is examined in the context of sickness absence and job insecurity, where reduced work participation may affect employees' perception of skills obsolescence.

The theoretical framework integrates insights from the Job Demands–Resources (JD–R) model and Conservation of Resources (COR) theory. Within the JD–R framework, perceived economic skills obsolescence is conceptualised as a job demand-related experience that emerges when employees perceive increasing difficulty maintaining the value of their skills within response to changing job requirements in their jobs, while development opportunities at work operate as a key job resource. From a COR perspective, perceived economic skills obsolescence reflects the loss of valuable resources, which undermines psychological resources such as learning attitude, learning efficacy and mastery. These frameworks explain how changing work environments affect employees' learning, motivation, health and continued participation at work.

The dissertation consists of four empirical chapters.

Chapter 2 examines how perceived economic skills obsolescence relates to employees' perceptions of development opportunities at work and whether this relationship is explained by learning attitude, learning efficacy and mastery, with age as a moderator. Using longitudinal survey data from employees in the telecommunications sector, the findings show that economic skills obsolescence

is both directly and indirectly related to perceived development opportunities at work. Indirect negative associations operate through learning attitude and mastery, while age strengthens the negative relationships between economic skills obsolescence and learning attitude and learning efficacy.

Chapter 3 focuses on older employees and examines how perceived economic skills obsolescence relates to sickness absence frequency and duration through work engagement and burnout. Using longitudinal data from the STREAM study (TNO), which is representative of employees aged 45 years and older in the Netherlands, the findings show that economic skills obsolescence is positively related to burnout and negatively related to work engagement. These processes explain higher sickness absence frequency and longer absence duration among older employees.

Chapter 4 analyses how perceived economic skills obsolescence and development opportunities at work relate to sickness absence through work engagement. Using cross-sectional survey data from a large Dutch telecommunications organisation, the results show that economic skills obsolescence is associated with higher sickness absence frequency through lower work engagement. Development opportunities at work are associated with lower perceived economic skills obsolescence, higher work engagement and fewer sickness absence episodes.

Chapter 5 examines whether sickness absence contributes to job insecurity through economic and technical skills obsolescence. Using longitudinal survey data, the findings show that economic skills obsolescence mediates the relationship between sickness absence duration and job insecurity, whereas technical skills obsolescence does not. This indicates that sickness absence can initiate a resource loss process in which reduced exposure to the work environment increases perceived economic skills obsolescence and job insecurity.

Across the empirical chapters, the findings show that perceived economic skills obsolescence functions as a central mechanism through which changing work environments affect employees' learning, motivation, health and work participation, highlighting why similar workplace changes can lead to different outcomes for different employees.

Samenvatting

Dit proefschrift onderzoekt hoe werknemers economische en technische kwalificatieveroudering ervaren en hoe deze percepties samenhangen met ontwikkelmogelijkheden in het werk, psychologische hulpbronnen, bevlogenheid, burn-out, ziekteverzuim en baanonzekerheid. Technologische en organisatorische ontwikkelingen veranderen voortdurend werktaken, werkprocessen en vereiste vaardigheden. Hierdoor kunnen werknemers ervaren dat hun vaardigheden niet langer voldoende ondersteunen bij veranderende werkeisen.

Op basis van de human capital-literatuur maakt dit proefschrift onderscheid tussen economische en technische kwalificatieveroudering. Economische kwalificatieveroudering verwijst naar het waardeverlies van vaardigheden als gevolg van technologische en organisatorische veranderingen. Technische kwalificatieveroudering heeft betrekking op ervaren afname van fysieke of mentale capaciteiten die nodig zijn om werktaken uit te voeren, vaak als gevolg van veroudering, ziekte of langdurig niet-gebruik. De primaire focus van dit proefschrift ligt op ervaren economische kwalificatieveroudering, omdat deze vorm het meest direct samenhangt met hoe werknemers veranderingen in hun werk ervaren en erop reageren in hedendaagse werkomgevingen. Technische kwalificatieveroudering wordt onderzocht in de context van ziekteverzuim en baanonzekerheid, waar afwezigheid van werk van invloed kan zijn op de ervaren relevantie van vaardigheden.

Het theoretisch kader combineert inzichten uit het Job Demands–Resources (JD–R) model en de Conservation of Resources (COR) theorie. Binnen het JD–R model wordt ervaren economische kwalificatieveroudering opgevat als een werkeis-gerelateerde ‘stressor’ die ontstaat wanneer werknemers moeite ervaren om de relevantie van hun kennis en vaardigheden te behouden bij veranderende werkeisen. Vanuit COR theorie weerspiegelt ervaren economische kwalificatieveroudering het verlies van waardevolle hulpbronnen, wat samenhangt met lagere leerattitude, leereffectiviteit en mastery. Deze kaders verklaren gezamenlijk hoe veranderende werkomgevingen doorwerken in leren, motivatie, gezondheid en duurzame arbeidsparticipatie.

Het proefschrift bestaat uit vier empirische hoofdstukken.

Hoofdstuk 2 onderzoekt hoe ervaren economische kwalificatieveroudering samenhangt met percepties van ontwikkelmogelijkheden in het werk en in hoeverre deze relatie wordt verklaard door leerattitude, leereffectiviteit en mastery, met leeftijd als moderator. Op basis van longitudinale surveydata onder werk-

nemers in de telecommunicatiesector laten de resultaten zien dat economische kwalificatieveroudering zowel direct als indirect samenhangt met ontwikkelmogelijkheden in het werk. Indirecte negatieve relaties verlopen via leerattitude en mastery. Daarnaast versterkt leeftijd de negatieve relaties tussen economische kwalificatieveroudering en leerattitude en leereffectiviteit.

Hoofdstuk 3 richt zich op oudere werknemers en onderzoekt hoe ervaren economische kwalificatieveroudering samenhangt met de frequentie en duur van ziekteverzuim via bevlogenheid en burn-out. Met longitudinale data uit de STREAM-studie (TNO), representatief voor werknemers van 45 jaar en ouder in Nederland, laten de resultaten zien dat economische kwalificatieveroudering samenhangt met hogere burn-out en lagere bevlogenheid. Deze processen verklaren waarom oudere werknemers vaker en langer verzuimen.

Hoofdstuk 4 analyseert hoe ervaren economische kwalificatieveroudering en ontwikkelmogelijkheden in het werk samenhangen met ziekteverzuim via bevlogenheid. Op basis van cross-sectionele surveydata uit een grote Nederlandse telecommunicatieorganisatie laten de resultaten zien dat economische kwalificatieveroudering samenhangt met een hogere verzuimfrequentie via lagere bevlogenheid. Ontwikkelmogelijkheden in het werk hangen samen met minder ervaren economische kwalificatieveroudering, hogere bevlogenheid en minder ziekteverzuimepisoden.

Hoofdstuk 5 onderzoekt hoe ziekteverzuim bijdraagt aan baanonzekerheid via economische en technische kwalificatieveroudering. Op basis van longitudinale surveydata laten de resultaten zien dat economische kwalificatieveroudering de relatie tussen verzuimduur en baanonzekerheid medieert, terwijl technische kwalificatieveroudering dit niet doet. Dit wijst erop dat ziekteverzuim een proces van het verlies van hulpbronnen kan initiëren waarbij verminderde blootstelling aan de werkomgeving leidt tot hogere ervaren economische kwalificatieveroudering en meer baanonzekerheid.

Over de empirische hoofdstukken heen laten de bevindingen zien dat ervaren economische kwalificatieveroudering fungeert als een centraal mechanisme waarmee veranderende werkomgevingen doorwerken in leren, motivatie, gezondheid en arbeidsparticipatie, en verklaren waarom vergelijkbare veranderingen in werk voor werknemers tot uiteenlopende uitkomsten kunnen leiden.

About the author

Angela Messioui was born on 22 August 1983 in Maastricht, the Netherlands. She obtained a Bachelor's degree in Human Resource Management from the Amsterdam University of Applied Sciences in 2013. In 2017, she completed a post-bachelor programme in Casemanagement at the HAN University of Applied Sciences.



Before starting her doctoral research, Angela gained extensive professional experience in the field of sickness absence management.

In 2020, she joined the Research Centre for Education and the Labour Market (ROA) at Maastricht University as an affiliated PhD candidate. Her doctoral research was conducted under the supervision of Prof. dr. Andries de Grip, dr. Jos Sanders and Prof. dr. Tinka van Vuuren. In 2022, she graduated with a MSc degree in Management Studies at the Open University of the Netherlands. Throughout her doctoral trajectory Angela combined her academic research with (freelance) work as a sickness absence specialist for various companies. This strengthened the practical relevance and application of her research. She has presented her work at various national and international conferences and seminars.

Inspired by her father's migration from Morocco to the Netherlands, Angela intends to continue her research into the value of skills and labour market opportunities of migrant workers in Europe. She aims to further develop her career as an independent researcher and consultant, with a focus on skills development, labour market participation and sustainable employability.

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