

## ORIGINAL ARTICLE OPEN ACCESS

# Necessary HRM Practices for Extended Working Lives in Tight and Loose Societies: A Comparative Perspective

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## ABSTRACT

The aging workforce demands evidence-based human resource practices that lengthen working lives. Building on the Conservation of Resources theory (Hobfoll 1989), we investigate which organizational practices are indispensable for expanding older workers' occupational future time perspective (OFTP)—people's perceived opportunities and remaining time at work (Zacher and Frese 2009). A necessary condition analysis of survey data from 3077 workers aged 50+ in nine countries tests nine domains of the Later Life Workplace Index (LLWI) as potential *minimal viable practices*. All domains exhibited statistically significant necessity effects; however, using the conventional threshold (Dul et al. 2023), only later life supportive leadership and adaptive work design reached the level considered *meaningfully necessary*. The remaining domains showed smaller, near necessity effects, suggesting a pattern of partial necessity across HRM practices. Exploratory analyses along the Tightness–Looseness cultural continuum suggested that necessity thresholds tended to be higher in culturally Tight than Loose societies, highlighting the importance of context-sensitive HRM. This study refines theorizing on career sustainability, introduces necessity logic to the work and aging literature, and offers managers evidence-based tools to prevent insurmountable shortcomings. Failure to meet the identified LLWI thresholds will typically result in suboptimal OFTP.

## 1 | Introduction

“The notion that HRM activities are necessary conditions for achieving certain outcomes is widespread in HRM research” (Hauff et al. 2021, 18), and we argue that they might play an important role in light of workers' career sustainability as well

(Van der Heijden and De Vos 2015), with older workers being no exception (Aksoy and Marcus 2024). Given the current demographic changes, that is the aging and dejuvenization of the working population (Sokolovsky 2020), the overarching purpose of this study is to move our evidence-based knowledge on how to accommodate age-related changes in needs and capacities in late

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career (Fasbender et al. 2019), and on how to keep older workers in employment (cf. Rudolph et al. 2018) forward. Therefore, we apply a *necessity perspective* (i.e., examining whether a given condition is critical for an outcome of interest) to explain the relationship between organizational HRM practices for older workers and their occupational future time perspective (OFTP), which refers to workers' perceptions of their future in employment (Zacher and Frese 2009).

In line with Korff et al. (2017), the notion of OFTP is supposed to be an underlying mechanism through which HRM practices affect work-related attitudes and behaviors (cf. Zacher and Frese 2009, 2011). As OFTP “appears to have a motivational and salutogenic function in the work context” (Rudolph et al. 2018, 231), it is an important indicator of the extension of working lives. We argue that further research on OFTP enablers is necessary to gain insight into valuable catalysts for the career sustainability of older workers (De Vos et al. 2020; Van der Heijden et al. 2020). Being aware of the effects that late career experiences have on the form and timing of later exit from the workforce (Brydsten et al. 2023), we have focused on workers aged 50 years and above, which is also a distinct age cut-off point in international research (Harris et al. 2018).

For the present study, the Later Life Workplace Index (LLWI) is chosen as a framework for HRM practices that are believed to be essential to older workers' career sustainability. It also served as an initial starting point for the ISO Standard No. 25550:2022 Aging Societies—General Requirements and Guidelines for an Age-inclusive Workforce (International Organization for Standardization 2022). The LLWI provides a scientifically developed framework for organizational practice domains, including their measurement, and covers nine distinct domains of organizational HRM practices for the aging workforce, namely organizational climate, leadership, work design, health management, individual development, knowledge management, transition to retirement, continued employment after retirement, and health and retirement coverage<sup>1</sup> (Finsel et al. 2023). Besides, each domain comprises categories of organizational HRM practices relevant to the context of older workers and an aging workforce (Wilckens et al. 2021).

Specifically, in this empirical work, we explore the relationship between the nine domains of LLWI and OFTP. We consider each domain a necessary rather than a probabilistically sufficient condition for an extended OFTP. Moreover, as context plays a pivotal role in understanding most organizational behaviors (Johns 2006), we build on the multilevel theoretical framework of Marcus and Fritzsche (2016) that specifies the mechanisms by which age and culture interact to predict age discrimination across different levels of culture as the basis for categorizing the nine national samples included in our study. This multilevel theoretical framework proposes the core societal cultural dimension of tightness vs. looseness (i.e., reflecting a core aspect of different societal contexts in the nine countries included in our study). It is consistent with North and Fiske's (2015) meta-analytic study, which explains age discrimination-related psychological findings.

Since most social phenomena—with career sustainability (De Vos et al. 2020; Van der Heijden and De Vos 2015) being no

exception—are inherently difficult to define in terms of deterministic causation, our assumptions are grounded in a *quasi-deterministic* or typicality interpretation of necessity causality (Dul 2024a; Lee and Lu 2025). Specifically, a *quasi-deterministic* necessity logic suggests that the absence of the LLWI organizational HRM practices for older workers typically results in the absence of an extended OFTP, while allowing a few exceptions. By acknowledging outliers, the *quasi-deterministic* or typicality necessity perspective that we take in our scholarly work overcomes the shortcomings of an absolute view on necessity logic, which may not be realistic and useful in theorizing on most social realities (Lee and Lu 2025). Furthermore, it contributes to simplicity, one of the key advantages of necessity theorizing (Lee and Lu 2025), and as Lee and Lu (2025, 230) put it, “Good theories can be those that are pithy—that is, simple yet comprehensive.”

Our study contributes to the literature in four important ways. First, we add to the scarce knowledge of factors that are essential to extend working lives by examining the necessity effects of HRM practices on OFTP, which has proven to be an important predictor of work and career outcomes, such as retirement intentions (Rudolph et al. 2018). In doing so, we add to previous work in this field that has mainly focused on unidimensional conceptualizations of age-oriented HRM practices instead of bundles of HRM practices that comprise a composition of several sub-dimensions depending on their focus (Chong et al. 2025). As such, our approach responds to calls from the literature to adopt a multi-dimensional model in research on successful aging (e.g., Zacher and Yang 2016) by including “perceptions of more specific age-related organizational policies, norms, practices, and procedures related to topics such as recruitment, training, performance, appraisal, and promotion” (ibid. p. 9). Building on the Conservation of Resources theory (CoR, Hobfoll 1989), we argue that older workers must have access to organizational HRM practices in order to protect their career sustainability; without such support, they cannot maintain an expanded OFTP.

Second, we revisit the investigation of the predictive value of HRM practices from a necessity perspective, and employ *necessary condition analysis* (NCA) to explore whether the nine LLWI domains are all necessary for an expanded OFTP. NCA represents both a causal logic and an analytical framework specifically designed to examine necessity relationships. Rather than relying on probabilistic or configurational causality, NCA identifies conditions that are indispensable for an outcome to occur and aligns theoretical reasoning with its analytical approach to ensure theory–method fit (Dul 2021). Whereas conventional causal approaches, such as regression analysis and Qualitative Comparative Analysis (QCA), focus on sufficiency logic—that is, estimating the extent to which a condition contributes to an outcome—NCA adopts a different causal perspective based on necessity logic. In regression, the presence and magnitude of a condition increase the probability or level of an outcome. Similarly, QCA identifies combinations of conditions that are sufficient or necessary for an outcome but often treats necessity and sufficiency symmetrically. By contrast, NCA posits that a necessary condition must be present for the outcome to occur, but its presence alone does not guarantee the outcome, thus emphasizing bottleneck logic. All in all, adopting a *necessity perspective* widens our capacity to explicitly steer organizational

HRM practices according to the desired outcome (Aguinis et al. 2020; Boon et al. 2019).

Third, we will investigate the impact of core societal context, in particular *cultural anchors of age discrimination in organizations, by comparing different country clusters of Tight vs. Loose societies* (see the next section on Theorizing and the Measures section for more information) as a possible moderator in empirical work. In doing so, we add to the limited amount of scholarly research on the mechanisms underlying the relationships between age, culture, and work and career outcomes, thereby responding to the call by Marcus and Fritzsche (2016) for conducting systematic research on age-based discrimination across cultures, by specifying a prime dimension of culture (i.e., Tight vs. Loose societies), and examining how this cultural dimension may act upon work and career outcomes, in our case OFTP. As knowledge about the relative influence of the core societal cultural dimension of tightness vs. looseness in driving age discrimination is particularly lacking (Marcus and Fritzsche 2016), our research will help to close an important gap in the literature.

Fourth, we also consider an important notion in the sustainable careers literature, namely, to examine the Person in interaction with their Context (De Vos et al. 2020; Van der Heijden et al. 2020; Van der Heijden and De Vos 2015). Specifically, examining which organizational HRM practices for older workers need to be present within a certain country cluster to be effective in expanding one's OFTP, even if they may not be probabilistically sufficient (Dul 2016) to do so, and investigating which practices make the difference between a limited vs. a more open OFTP can also help us increase our knowledge about how to prolong working lives across the globe.

## 2 | Theoretical Framework and Assumptions

This study employs NCA to explore the necessity of the nine LLWI domains for an expanded OFTP. In HRM systems, certain practices—such as later life supportive leadership or adaptive work design—must reach a minimum viable level before extended working lives become possible. NCA identifies such thresholds, showing when the absence of a practice makes an outcome unattainable. Importing the NCA logic into HRM pushes the field beyond averages and correlations. Instead of showing what helps to extend working lives, NCA pinpoints what *must* be in place, that is the “minimal viable HRM practices” that are needed for an expanded OFTP among older workers. Traditional probabilistic sufficiency-oriented statistics cannot do such clarification, and as a result, there is a growing body of literature positioning NCA as a complement to traditional regression approaches (Blom et al. 2024; Dul et al. 2023). These latter approaches often identify many determinants, making it difficult for managers to determine the most critical ones for a given outcome (Ding and Kuvaas 2023). Hence, exploring probabilistic sufficiency relationships does not meet the managerial brief; NCA must be performed because, in the absence of necessary conditions, “all other managerial practices are ineffective” (Ding and Kuvaas 2023, 269). In this line, NCA contributes to the HRM scholarship by opening the “black box” of critical HRM practices for extended working lives, re-specifying

core constructs, and changing continuous variables into managerial red lines.

All in all, NCA turns diffuse regression coefficients and broad averages into explicit must-haves, helping organizations to spend scarce resources where failure is otherwise guaranteed—exactly the kind of actionable insight HR managers have long called for. Furthermore, NCA strengthens evidence-based practice. Employers grappling with an aging workforce need defensible thresholds, not grand means.

### 2.1 | Workers' Occupational Future Time Perspective (OFTP)

In line with Korff et al. (2017), the notion of future time perspective (FTP), in our specific case OFTP, is used as the outcome variable in our empirical work, as it is supposed to play a key role in light of work-related attitudes and behaviors, herewith shaping older workers' career development as well (e.g., Hirschi and Koen 2021). Indeed, recent empirical work has already shown that OFTP plays a role in understanding how older workers build their careers (Fasbender et al. 2019; Henry and Desmette 2018) and predicts successful aging at work (Cheung et al. 2019).

OFTP comprises a lifespan development construct that refers to workers' perceptions about their future in the employment context (Zacher and Frese 2009). The construct of OFTP builds on the notion of FTP, being a central element in Socio-emotional Selectivity Theory (SST; Carstensen et al. 1999) that posits that FTP decreases with calendar age and predicts changes in goal orientation across the lifespan (ibid.). Zacher and Frese (2009, 2011), who adapted the FTP notion to the occupational context, argued that older workers see their occupational future as more limited in comparison with younger ones, and found that OFTP is negatively related to workers' calendar age (see also Rudolph et al. 2018; Van der Heijden 2006; Von Hippel et al. 2013). Meta-analytical findings indicate that overall OFTP explains important work outcomes, for example work engagement, retirement intentions, and task performance (Henry and Desmette 2018; Rudolph et al. 2018).

### 2.2 | Organizational HRM Practices as Necessary Conditions for Prolonged Working Lives

As indicated in the Introduction section, the aging workforce poses a multitude of challenges for employers and workers alike, as well as for policymakers, due to the growth of the older segment of the population and the unstable financial state of many of the public pension systems (Aksoy and Marcus 2024; Axelrad and Mahoney 2017). All parties should be responsible for keeping them engaged and productive, protecting their employability over time (Fugate et al. 2021), thereby fostering their career sustainability (De Vos et al. 2020; Van der Heijden et al. 2020; Van der Heijden and De Vos 2015). Unfortunately, organizations' investments in older workers' career development are often lacking (Mok et al. 2021), which, and even more distressingly, appears to lead to a self-fulfilling prophecy that, with aging, these workers take less initiative themselves as well (Van der Heijden 2005). This is even more problematic

considering older workers' pivotal role in shaping and enhancing positive HRM attributions in the organization (Aksoy and Marcus 2024).

Considering the negative impact of age on one's OFTP (ibid.), we contend that it is crucial to increase our understanding of critical ways to widen one's OFTP, even at later life stages, and maybe even further than that, so that working organizations can protect and ideally further enhance their workers' career sustainability until retirement age and beyond. We argue that organizational HRM practices for older workers are essential to help them cope with the turbulence and changes in today's internal and external labor markets (Fugate et al. 2021). They allow older workers to broaden their perception of opportunities and the remaining time in occupational activities. Besides, such practices are more important than ever, given the increasing globalization, workplace dynamics, and the ever-changing employer-employee relationships (Horney et al. 2010).

Although it is hard to believe that an older worker who lacks any organizational HRM practice will perceive an extended OFTP, people who are provided with ample opportunities do not always perceive an extended OFTP either. In other words, organizational HRM practices may differ in their effectiveness in extending older workers' OFTP.

CoR theory (Hobfoll 1989) is used as our underlying theorizing to explain the predictive value of organizational HRM practices for older workers (i.e., the LLWI) on OFTP. CoR comprises a motivational theory that, applied in the domain of work and careers, states that workers are motivated to obtain resources that they consider to be important. If they believe in getting access to important resources, they will be more likely to portray behaviors that are intended to further increase their resource pool (Hobfoll et al. 2018). Therefore, taking CoR theory as our theoretical lens, we conceive organizational HRM practices as necessary, contextual resources that transform into an expanded OFTP, being the outcome of resource investment. In addition, CoR theory supports the argument that organizations that provide access to these kinds of supportive, contextual resources in late career spans constrain the speed with which workers experience resource loss with aging. Besides, such organizations accommodate older workers' needs to acquire and accumulate the resources they need with aging, thereby improving their retention. In this way, CoR theory provides a clear theoretical foundation for understanding why specific HRM practices are indispensable for fostering older workers' career sustainability. According to CoR theory, certain resources are so vital that individuals must possess and invest in gaining them to prevent losses, recover from setbacks, and accumulate new resources (Hobfoll 1989, 2001; Hobfoll et al. 2018).

Principle 2 of CoR theory explicitly states that people must invest in resource gain to protect against loss, recover after loss, and gain further resources, capturing a necessity logic in which some resources are "must-haves" for maintaining one's performance and well-being. Applying this principle to an aging workforce, we argue that later life organizational HRM resources (i.e., the nine LLWI domains) function as such essential resources. Without these age-supportive resources, older workers are more likely to experience losses in energy, health,

or motivation. Consequently, they are unable to generate new resources, such as updated skills or role opportunities, thereby constraining their OFTP. Conversely, access to these HRM practices enables older workers to offset age-related resource depletion and foster positive gain spirals, as each newly acquired resource places them in a stronger position to gain further ones (Hobfoll et al. 2018).

In this sense, each LLWI domain represents a necessary precondition for sustaining an extended career outlook. If support in any given domain falls below a critical threshold, a prolonged OFTP will not materialize regardless of how strong other factors may be (Dul 2021, 2024a). Thus, following CoR's Principle 2, we conceptualize later life HRM practices not merely as beneficial resources but as indispensable conditions for maintaining older workers' career sustainability.

In short, building on CoR's Principle 2 (Hobfoll et al. 2018), we emphasize that sustaining older workers' OFTP depends on them having access to non-substitutable resource domains. When these domains fall below minimal functional thresholds, resource loss spirals occur that no other resources can offset. This principle of non-compensatory necessity (Dul 2021; Dul et al. 2023) frames our logic: later life HRM practices are not additive "nice-to-haves," but bottleneck resources that must reach a minimum level if extended working lives are to remain viable.

### 2.3 | Necessity Thinking to Better Understand the Association Between Organizational HRM Practices and OFTP

One can find many examples of necessity claims in the realm of the OFTP and sustainable careers literature, particularly regarding their organizational and contextual determinants. Researchers have stressed that "organizations face the challenges and opportunities of adapting workplaces and management practices to meet the **needs**<sup>2</sup> and interests of a workforce that is both aging and more age diverse" (Chong et al. 2025), (1). Other scholars emphasized that it "is necessary to create age-friendly policies [*LLWI transition to retirement and continued employment domains, our italic*] (...) because many older workers were usually discriminated by their age, which **inhibits** them from aging successfully and working longer" (Cui et al. 2025, 26). Moreover, others claimed that "more decision possibilities on the job [*LLWI adaptive work design domain, our italic*] **enable** older workers to adjust their tasks to their capabilities and their preferred way of working" or that "higher complexity and control [*LLWI adaptive work design domain, our italic*] also **allow** older workers to better utilize and transfer their increased knowledge and work experience" (Zacher and Frese 2009, 488).

Importantly, necessity claims such as these imply a necessity deterministic or typicality logic (Dul 2024a). Considering that many workplace phenomena may include determinants that are necessary conditions above and beyond probabilistically sufficient ones (Dul 2016; Hauff et al. 2021) and as we still do not know which HRM practices are critical for an extended OFTP, this study fills a theoretical gap by examining the influence of HRM practices in OFTP among older workers with a necessity logic (Van Beurden et al. 2022). For example, without later-life

supportive leadership, workers cannot preserve motivational resources necessary for continued participation, even if development or health programs exist, since socio-emotional support is non-substitutable. Similarly, without adaptive work design, other benefits such as training or wellness initiatives cannot overcome structural inflexibility that blocks gain spirals. In CoR terms, these absences produce loss spirals that deplete energy and self-efficacy faster than the speed at which other resources can be accumulated.

Following Dul (2021, 2024a), each domain thus functions as a necessary-but-not-sufficient condition: its absence constrains higher OFTP, regardless of other resource surpluses. This non-compensatory reasoning extends CoR theorizing by clarifying that individuals with insufficient access to any critical LLWI domain remain vulnerable to resource loss even when well-endowed in others. Hence, LLWI domains operate as interconnected *resource minima* rather than interchangeable assets. Transcending these *minima* enables gain spirals; falling below any one prevents them. This reasoning also clarifies why necessity relationships differ conceptually and empirically from additive or compensatory ones. In other words, in a sufficiency model, multiple HRM practices may each contribute partially to an extended OFTP, so high scores on one practice can offset deficiencies in another. In contrast, under necessity logic, no such substitution is possible: the absence of any one indispensable practice creates a bottleneck that prevents the desired outcome regardless of the abundance of other supports (Dul et al. 2023). Thus, LLWI domains act as non-fungible resources; each domain must meet a minimal viable level to enable sustained optimism and engagement about one's occupational future. Moreover, the necessity interpretation reframes the role of HRM bundles of practices for older workers. Instead of operating as mutually reinforcing components of a cumulative system, LLWI domains form a threshold system in which the weakest element determines the upper bound of workers' OFTP. For example, generous health programs will not expand OFTP if adaptive work design remains rigid, because rigid work structures continue to deplete energy and restrict perceived opportunities. Under these circumstances, the worker's OFTP ceiling is dictated by the most deficient domain rather than by the mean availability of resources across domains. In addition, CoR Principle 2 implies a temporal dynamic: once critical HRM resources fall below threshold, loss spirals accelerate, making later compensatory investments less effective. This temporal asymmetry reinforces the necessity logic: preventing resource depletion *ex ante* is more effective than trying to restore it *ex post* (Hobfoll et al. 2018). Hence, organizational interventions must ensure continuous access to these key domains before losses occur, because later efforts cannot fully restore the depleted motivational and cognitive resources needed to protect and further enhance older workers' career sustainability.

Finally, the integration of CoR and necessity theories highlights that necessity does not imply sufficiency or guarantee sustainable careers. Providing high levels of LLWI resources only permits older workers to envision longer OFTP; it does not ensure they will do so. However, without meeting the minimal thresholds across these domains, such futures are typically impossible. This view enriches both CoR and sustainable career theorizing

by specifying why and when particular HRM resources become irreplaceable preconditions for maintaining later life sustainability.

## 2.4 | The Impact of Context: Cultural Anchors of Age Discrimination in Organizations

As with many other organizational behavior phenomena (Johns 2006), with career sustainability being no exception (De Vos et al. 2020), the LLWI-OFTP relationship can only be understood when considering the interaction between the individual and their context. Therefore, we build on the multilevel theoretical framework of Marcus and Fritzsche (2016) that specifies the mechanisms by which age and culture interact to predict age discrimination across multiple levels of culture. The authors drew from theories in both the social and cross-cultural psychology domains. Their framework (p. 219) specifies the posited impacts of core dimensions of culture across multiple levels of analysis, including societal, organizational, and individual levels, on relationships between age, on the one hand, and work and career outcomes, on the other hand. Because one of the foci in our research lies in the interaction between age and culture, and age discrimination concerns in-group favoritism, a better understanding of the impact of the normative focus on individuals vs. groups is of particular importance in our research.

Nevertheless, our knowledge about the relative influence of each of the two core societal cultural dimensions that drive age discrimination in Marcus and Fritzsche (2016), that is, Tightness–Looseness (T-L) and Individualism–Collectivism (I-C), is asymmetrical. Indeed, while research on the former is well established (e.g., Hofstede 1980), the study of cultural T-L implications is an emerging area of research (Gelfand et al. 2011). We focus on cultural T-L as the key cultural dimension because it centers on the strength of social norms and tolerance for deviant behavior. In contrast, I-C is concerned with the emphasis on individuals versus groups. In other words, unlike I-C (i.e., a values-based dimension referring to the amount of group integration), T-L directly captures how strictly societies enforce norms.

This distinction is crucial for our study since later life HRM practices are fundamentally normative in nature—they involve setting, reinforcing, or relaxing organizational norms around older workers. Indeed, prior research emphasizes that T-L is defined by the strength and clarity of social norms and the degree of sanctioning for norm deviance, making it a conceptually appropriate lens for examining normative HRM practices. Moreover, T-L has proven highly relevant for understanding how societies respond to challenges: for example, tight cultures (with strict norms and punishments) help groups to coordinate survival in the face of collective threats (Gelfand 2021). This underlines the broad importance of norm strength in social systems (Gelfand et al. 2006; Gelfand 2021). Therefore, because our interest lies in how organizations uphold or relax norms for older workers, we focus on a culture's tightness (strict norms, low tolerance for deviation) versus looseness (permissive norms, high tolerance) as we contend that this should have more direct bearing on later life HRM practices than I-C. We thus argue that T-L is the more pertinent cultural dimension for our context, and we have accordingly built our hypotheses around cultural T-L.

Although we rely on a T-L categorization for clarity, we acknowledge that T-L is a continuous cultural property. Our grouping follows the heuristic convention adopted by Marcus and Fritzsche (2016) and the global indices by Gelfand et al. (2011) and Uz (2015). Accordingly, all interpretations refer to comparative tendencies rather than to rigid, mutually exclusive cultural types. In more detail, from a sociocultural perspective, biases, including age discrimination, against members of different demographic categories stem from in-group/out-group categorization processes, become salient in the form of social identities, and entail societal/group norms and individual cultural orientations. The latter has implications for the extent to which ageism occurs (Marcus and Fritzsche 2016). As Tight cultures have been exposed to a high degree of ecological and/or human-made threats, they are supposed to be characterized by a predominance of strong situations in everyday life and a restricted range of permissible behavior. On the contrary, Loose cultures have had few ecological and human-made threats, which resulted in a predominance of weak situations and more social latitude (Gelfand et al. 2011). Considering that Tight societies have tighter group boundaries, constrict the range of socially acceptable personal norms, and have a low tolerance for deviant behavior (Gelfand et al. 2011; Uz 2015), and given the fact that older workers are not a dominant social group (Marcus and Fritzsche 2016; North and Fiske 2015), in line with Marcus and Fritzsche (2016), we expect them to face more age discrimination than older workers in Loose societies. As a result, older workers in Tight cultures tend to report lower job satisfaction, display higher turnover intentions, and face increased stereotyping, prejudice, and unfair treatment from supervisors and co-workers relative to their counterparts in Loose societies (Marcus and Fritzsche 2016). However, it has also been found that higher-level culture (e.g., the in-group societal culture ranging from Tight to Loose) can moderate the relationships between age, lower-level culture, and work-related outcomes. We, therefore, argue that to combat the negative effects of age discrimination, the relative importance of LLWI domains in enabling older workers' OFTP is typically higher in Tight societies.

In short, we focus on T-L because it reflects the strength of social norms, which influence how older workers experience HRM practices (Gelfand et al. 2011; Uz 2015). Drawing on Principle 2 of CoR theory, we argue that individuals must invest and possess certain key resources to prevent losses, recover from them, and achieve further gains (Hobfoll 1989, 2001; Hobfoll et al. 2018). This “must-have” principle aligns with necessity logic: without later-life HRM resources, older workers cannot extend their OFTP. In tight cultures, where behavioral latitude is narrow, the lack of such resources imposes particularly strong constraints.

All in all, our theoretical contribution articulates a necessity-based logic that fuses CoR Principle 2 (Hobfoll et al. 2018) with non-compensatory theorizing (Dul 2021, 2024a; Dul et al. 2023). We treat LLWI domains as minimum viable resource conditions: if any of them is lacking, extended OFTP cannot be sustained. This conceptualization grounds our hypotheses in a quasi-deterministic necessity logic, which is consistent with the principle that “people must invest resources in order to protect against resource loss, recover from losses, and gain resources”

(Hobfoll et al. 2018, 106). Based on this theoretical outline and on a typicality interpretation of necessity causality (Dul 2024a; Lee and Lu 2025), the following necessity hypothesis was formulated:

**Hypothesis 1.** *The LLWI domains are typically necessary for an expanded OFTP.*

Because NCA currently lacks a formal procedure for testing statistical differences between groups, we examined cultural T-L descriptively and post hoc. This comparison is exploratory and intended to reveal patterns rather than to test a confirmatory hypothesis. We retained the T-L heuristic for theoretical alignment with prior cross-cultural HRM research, but explicitly note that cultures vary along a continuum of normative strength. Hence, we pose the following research question:

RQ. Does the degree of necessity of later life HRM resources for an expanded OFTP differ between culturally Tight and culturally Loose societies?

We anticipated, conceptually, that older workers in tighter cultures might face higher minimum requirements regarding LLWI domains to achieve a given level of OFTP (i.e., stronger necessity effects) compared to those in looser cultures. In other words, we treated our inquiry as exploratory, rather than a formal hypothesis, since we aimed to assess patterns of necessity across different cultural contexts descriptively.

### 3 | Methodology

#### 3.1 | Sample and Procedure

Nine national samples from Belgium, Germany, Italy, Japan, Norway, Poland, Portugal, the Netherlands, and the U.S. were collected through a cross-sectional design ( $N = 3077$ ). Panel providers or survey platforms were used to increase the representativeness of the samples. Participants were required to be at least 50 years old, to work for at least 1 year at an organization with at least 30 workers, and to work at least 20 h per week to ensure that they had access to and knowledge of organizational practices for older workers. In all samples, except the Norwegian one, instructed response items and survey timings were applied to detect and remove inattentive participants. Apart from Italy and Poland, the LongString Index was used to screen out inattentive participants for all these samples. The LongString Index is used to detect invariant responses (Curran 2016) and was computed by calculating the maximum number of identical consecutive answers to a specific string of questions. We then excluded participants whose LongString Index was an outlier ( $1.5 \times \text{IQR}$ ). We used the LongString Index function in R from the *careless* package (Version 1.2.2.) by Yentes and Wilhelm (2023) to compute the LongString Index for the LLWI items.

Building on the categorization of societies along the dimension of in-group tightness-looseness, as developed by Marcus and Fritzsche (2016), we grouped the national samples into two clusters. These clusters are based on extensive cross-cultural research that identified the level of cultural tightness and looseness among almost 100 countries (Gelfand et al. 2011;

Uz 2015). In this vein, the Tight cluster ( $n=844$ ) comprised Japan, Poland and Norway, while the Loose cluster ( $n=2233$ ) included Germany, the U.S., the Netherlands, Belgium, Italy, and Portugal.

We recognize that countries close in tightness scores may fall into different clusters when dichotomized. To mitigate this limitation, full per-country NCA summaries are reported in Appendix A. These include individual effect sizes, bottleneck tables, and scatterplots to ensure transparency and enable replication.

### 3.2 | Measures

For all constructs in this study, a back-translation technique (i.e., Brislin 1970) was used to translate the items from German or English into other languages. All constructs were measured on a rating scale ranging from 1 (strongly disagree) to 7 (strongly agree). Internal consistency for all scales was at least acceptable (see Table 1).

In this study, the perceived provision of the LLWI domains by older workers was measured with the short-form instrument developed by Finsel et al. (2025). The original measure consists of an 80-item multi-dimensional measure of organizational practices relevant to older workers' ability, motivation, and opportunity to continue working in later life (Wilckens et al. 2021). The validated Later Life Workplace Index Short Form (LLWI-SF)

(Finsel et al. 2025; Wilckens et al. 2021), consisting of 29 items, covers the same nine distinct domains of organizational practices for the aging workforce (Appendix B).

OFTP was measured with the validated six-item scale developed by Zacher and Frese (2009). A sample item is: "Many opportunities await me in my occupational future."

### 3.3 | Analytical Strategy: NCA

Following recent guidelines for good NCA practice (Dul et al. 2023), we explored whether the nine LLWI domains are necessary for an expanded OFTP using *Version 4.0.2.* of the R package *NCA* (Dul 2024b). This package evaluates bivariate XY data patterns through scatter plots using a ceiling line that marks the boundary between the space with and without observations. An empty top-left corner in the X-Y scatterplot signals a necessary condition, with the necessary effect being stronger if the empty zone is larger. The absence of points in this area shows that low X values limit the occurrence of high Y values. Put differently, low X values become a bottleneck for reaching high Y values. The *NCA* package also computes NCA parameters like effect size and  $p$  value, and produces bottleneck tables. The latter comprises a tabular representation of the necessary condition(s) needed for a certain outcome level, according to the selected ceiling line (Dul 2024b; Hauff et al. 2021). Given that our study's data around the ceiling line did not follow a linear pattern (non-linearity of the border), we

**TABLE 1** | Descriptive statistics and correlations for the total sample.

| Variable                            | <i>M</i> | <i>SD</i> | 1       | 2       | 3       | 4       | 5       | 6       | 7       | 8       | 9       | 10     |
|-------------------------------------|----------|-----------|---------|---------|---------|---------|---------|---------|---------|---------|---------|--------|
| 1. Later life supportive climate    | 4.81     | 1.33      | (0.77)  |         |         |         |         |         |         |         |         |        |
| 2. Later life supportive leadership | 4.73     | 1.47      | 0.69*** | (0.93)  |         |         |         |         |         |         |         |        |
| 3. Adaptive work design             | 4.09     | 1.33      | 0.47*** | 0.62*** | (0.78)  |         |         |         |         |         |         |        |
| 4. Health management                | 3.69     | 1.50      | 0.41*** | 0.54*** | 0.65*** | (0.79)  |         |         |         |         |         |        |
| 5. Individual development           | 4.21     | 1.45      | 0.53*** | 0.67*** | 0.65*** | 0.68*** | (0.82)  |         |         |         |         |        |
| 6. Knowledge management             | 4.25     | 1.52      | 0.55*** | 0.69*** | 0.59*** | 0.61*** | 0.75*** | (0.87)  |         |         |         |        |
| 7. Transition to retirement         | 3.31     | 1.57      | 0.47*** | 0.58*** | 0.60*** | 0.67*** | 0.66*** | 0.68*** | (0.90)  |         |         |        |
| 8. Continued employment             | 3.83     | 1.43      | 0.53*** | 0.61*** | 0.61*** | 0.60*** | 0.65*** | 0.67*** | 0.75*** | (0.73)  |         |        |
| 9. Health and retirement coverage   | 3.67     | 1.73      | 0.36*** | 0.49*** | 0.55*** | 0.58*** | 0.55*** | 0.52*** | 0.63*** | 0.59*** | (0.84)  |        |
| 10. OFTP                            | 3.47     | 1.26      | 0.27*** | 0.36*** | 0.37*** | 0.39*** | 0.41*** | 0.42*** | 0.42*** | 0.45*** | 0.37*** | (0.85) |

Note: \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$ .  $N = 2892-3077$  for all variables. Reliabilities (coefficient alpha) are in parentheses.

chose ceiling envelopment with a free disposal hull (CE-FDH) as our ceiling technique (Dul 2016). Unlike ceiling regression with a free disposal hull (CR-FDH), which is another common technique used to draw ceiling lines in NCA, CE-FDH precision is 100%, so no observations are above the ceiling line. Hence, a piece-wise line like CE-FDH is the most suited to capturing our data pattern.

NCA is highly sensitive to extreme observations; if left unaddressed, such outliers can obscure a necessary effect and materially alter a study's conclusions (Dul 2021, 2024a; Dul et al. 2023). Similarly to our hypothesis and research question development, we followed a *quasi-deterministic* or typicality perspective in the analysis, which allowed us to detect and remove outliers (Dul 2024b; Lee and Lu 2025). We excluded single, double, ceiling, and scope outliers when their removal would change—increasing or decreasing—the original effect size by at least 20%. To maintain transparency, we capped outlier deletions at 1% of the sample per analysis and reported the original effect sizes (Aguinis et al. 2013). We also omitted control variables, as those variables did not change the influence of the necessary determinants of interest within the NCA framework (Dul 2021).

Considering that we analyzed relationships of necessity not only in kind (Hypothesis 1) but also in degree (as explored in our RQ), we followed the standard criteria for testing necessity hypotheses (Dul et al. 2023) and explicitly defined a threshold for the necessity effect size ( $d$ ). For the binary decision of whether a condition qualifies as “necessary” (Hypothesis 1), we adopted  $d \geq 0.10$  as the criterion for a meaningful necessity effect (Dul 2016; Dul et al. 2023). This threshold, widely used in the NCA literature, indicates that the condition constrains at least 10% of the outcome space. Although any cut-off value involves some arbitrariness, 0.10 balances statistical conservatism and substantive interpretability given our large sample sizes. Values below 0.10 are therefore interpreted as “near necessity” effects, that is, patterns consistent with the logic of necessity in degree but not sufficient to meet the binary criterion. At the same time, we acknowledge that setting a universal threshold is challenging (Ding and Kuvaas 2023) and may lead to overly dichotomous conclusions that overlook theoretically relevant “near necessities”. Therefore, following Ding and Kuvaas (2025) rationale, we report both the effect sizes and the theoretical thresholds proposed by Dul (2016) to enhance transparency and practical interpretability. In addition, and in line with Dul et al. (2020), we conducted 10,000 permutation tests ( $p < 0.05$ ) to assess the statistical significance of each necessity effect.

Given that NCA is a relatively new method, demonstrating the power and robustness of our samples is imperative. Dul (2024b) provides guidance on necessary sample sizes for NCA and on how to consider power. According to Dul (2024b), a typical sample size of around 180 in business research will probably entail enough power to detect a necessary condition that is present in the population. Our study's samples are substantially larger—approximately 3000 individuals in the total sample and two large cluster samples with around 850 individuals in the Tight cluster and around 2200 in the Loose cluster—which affords our NCA a very high statistical power. In practical terms, this

**TABLE 2** | Necessary conditions analyses—total sample and per cluster.

| Conditions                          | OFTP         |         |         |
|-------------------------------------|--------------|---------|---------|
|                                     | Total sample | Tight   | Loose   |
| 1. Later life supportive climate    | 0.08**       | 0.13*   | 0.15*** |
| 2. Later life supportive leadership | 0.13***      | 0.23*** | 0.15*** |
| 3. Adaptive work design             | 0.10***      | 0.17*** | 0.11*** |
| 4. Health management                | 0.07***      | 0.12*** | 0.09*** |
| 5. Individual development           | 0.08***      | 0.09*** | 0.10*** |
| 6. Knowledge management             | 0.09***      | 0.15*** | 0.10*** |
| 7. Transition to retirement         | 0.07***      | 0.07*   | 0.07*** |
| 8. Continued employment             | 0.07***      | 0.11*** | 0.10*** |
| 9. Health and retirement coverage   | 0.05**       | 0.10**  | 0.06**  |

Note: \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$ . Outliers that changed—increased or decreased—the original effect size by 20% or more were removed (We handled outliers in our NCA following recommended procedures for large samples (Dul 2024b). Specifically, we iteratively removed cases that, when excluded, increased or decreased the effect size  $d$  by approximately  $\geq 20\%$ , up to a maximum of 1% of the sample removed. In the total sample analysis ( $N = 3077$ ), this process identified five to eight outlier cases (0.16% to 0.26% of  $N$ ). Beyond eight, no further removal raised  $d$  by 20% or more. For the Tight and Loose subgroup analyses, we similarly removed at most eight cases in the Tight cluster ( $N = 844$ , 0.95%) and four to nine cases in the Loose cluster ( $N = 2233$ , 0.18%–0.40%, varying slightly by domain). We stopped removing outliers once additional outlier candidates yielded diminishing returns ( $< 20\%$  in terms of  $d$  gains) or would exceed the 1% cap. Because NCA can return multiple combinations of outliers in large datasets, different cases were excluded in the total versus subgroup analyses. This sometimes led to patterns present in the total sample not appearing in a subgroup (see the discussion on Table 3). We opted for consistency by applying the same 20%/1% criterion in all analyses, balancing effect size improvement with sample retention. We removed five to eight outliers in testing Hypothesis 1 (four in the health and retirement coverage domain and eight in the leadership and transition to retirement domains). The original effect sizes, without removing these outliers, were as follows: later life supportive climate ( $d = 0.03$ ,  $p = 0.56$ ); later life supportive leadership ( $d = 0.05$ ,  $p = 0.05$ ); adaptive work design ( $d = 0.02$ ,  $p = 0.51$ ); health management ( $d = 0.02$ ,  $p = 0.10$ ); individual development ( $d = 0.03$ ,  $p = 0.25$ ); knowledge management ( $d = 0.04$ ,  $p = 0.06$ ); transition to retirement ( $d = 0.01$ ,  $p = 0.32$ ); continued employment ( $d = 0.02$ ,  $p = 0.53$ ); and health and retirement coverage ( $d = 0.03$ ,  $p = 0.02$ ). We also removed eight outliers in the Tight cluster in answering our RQ and between four to nine in the Loose cluster (four in the health and retirement coverage domain and nine in the adaptive work design domain). The original effect sizes in the Tight cluster were: later life supportive climate ( $d = 0.04$ ,  $p = 0.86$ ); later life supportive leadership ( $d = 0.09$ ,  $p = 0.28$ ); adaptive work design ( $d = 0.08$ ,  $p = 0.06$ ); health management ( $d = 0.04$ ,  $p = 0.17$ ); individual development ( $d = 0.06$ ,  $p = 0.31$ ); knowledge management ( $d = 0.05$ ,  $p = 0.34$ ); transition to retirement ( $d = 0.05$ ,  $p = 0.12$ ); continued employment ( $d = 0.02$ ,  $p = 0.72$ ); and health and retirement coverage ( $d = 0.04$ ,  $p = 0.15$ ). As for the Loose cluster, original effect sizes were: later life supportive climate ( $d = 0.04$ ,  $p = 0.54$ ); later life supportive leadership ( $d = 0.05$ ,  $p = 0.08$ ); adaptive work design ( $d = 0.02$ ,  $p = 0.58$ ); health management ( $d = 0.02$ ,  $p = 0.11$ ); individual development ( $d = 0.03$ ,  $p = 0.35$ ); knowledge management ( $d = 0.04$ ,  $p = 0.13$ ); transition to retirement ( $d = 0.01$ ,  $p = 0.31$ ); continued employment ( $d = 0.02$ ,  $p = 0.54$ ); and health and retirement coverage ( $d = 0.04$ ,  $p = 0.02$ ). NCA effect size thresholds (Dul 2016): small:  $0 < d < 0.10$ ; medium:  $0.10 \leq d < 0.30$ ; large:  $0.30 \leq d < 0.50$ ; very large:  $d \geq 0.50$ .

means our analysis is well-equipped to identify even relatively small necessity effects ( $d \sim 0.05$ – $0.10$ ) with a high degree of confidence. In other words, if a meaningful necessity relationship exists in the population, our sample size is sufficient to uncover it reliably.

## 4 | Results

Means, standard deviations, correlations, and reliabilities for all study variables are shown in Table 1.

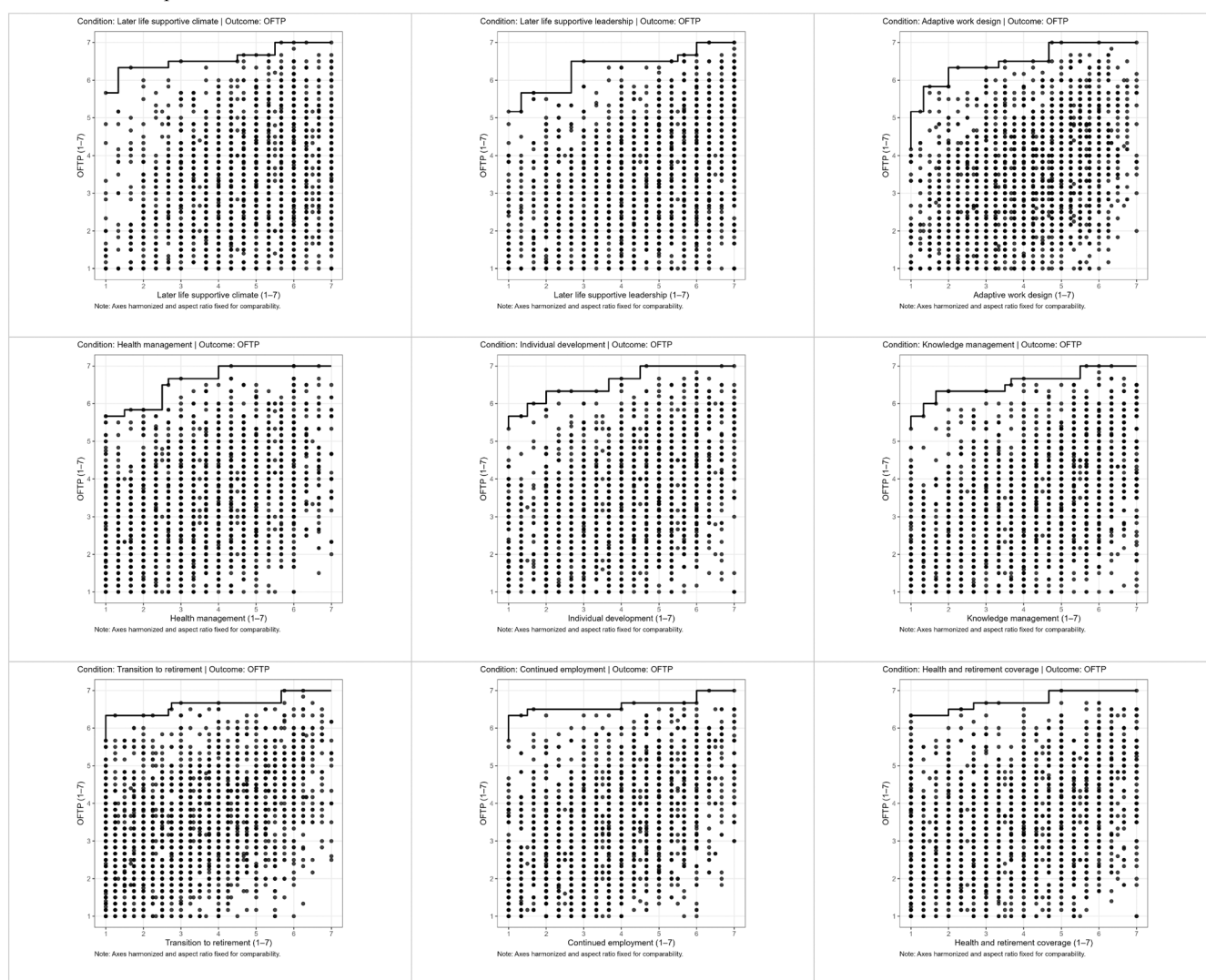
We conducted NCA to test our hypothesis and research question and reported the results based on recent recommendations for good NCA practice (Dul et al. 2023). Using  $d \geq 0.10$  as the binary criterion for identifying a necessary condition (Dul 2016; Dul et al. 2023), Table 2 shows that, in the total sample, two of the nine LLWI domains, that is later life supportive leadership and adaptive work design, meet this threshold. Apart from health and retirement coverage ( $d = 0.05$ ,  $p < 0.01$ ), the remaining domains display  $d$  values between 0.07 and 0.09, representing “near necessity” effects that approach but do not reach the conventional cut-off. The permutation tests (10,000 resamples) conducted for all the LLWI domains-OFTP relationships showed that necessity effects could not be attributed to randomness, so all the effects were considered statistically significant (Dul et al. 2020). According to statistical guidelines (Dul 2016), the necessity effects of later life supportive leadership and adaptive work design should be

considered medium effects ( $0.10 \leq d < 0.30$ ). All the other effects of LLWI domains on OFTP fell into the small effect size category ( $d < 0.10$ ,  $p < 0.05$ ).

Figure 1 shows the scatter plots with the ceiling line CE-FDH for the total sample (Panel 1) and per cluster (Panels 2 and 3) for the theorized relationships between the LLWI domains and OFTP. An empty area in the upper-left corner of the scatter plot indicates necessary conditions. Given that necessity effects are stronger the larger the empty area is, the later life supportive leadership  $\times$  OFTP plot has the largest empty area of all plots depicted in Panel 1.

Following Ding and Kuvaas (2025), rather than opting for binary decisions about conditions (necessary vs. non-necessary) based on a specified threshold (Dul 2016), we contend that the theoretical and practical relevance of necessity effects should be judged not only in *kind*, that is, in an absolute fashion, but also in *degree*. Along with analyzing relationships of necessity *in kind*, NCA also allows us to make statements *in degree* (Ding and Kuvaas 2025; Dul 2021; Vis and Dul 2018). Table 3 shows the specific levels of the conditions, that is the LLWI

Panel 1: Total sample



**FIGURE 1** | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH)—total sample and per cluster.

Panel 2: Tight cluster

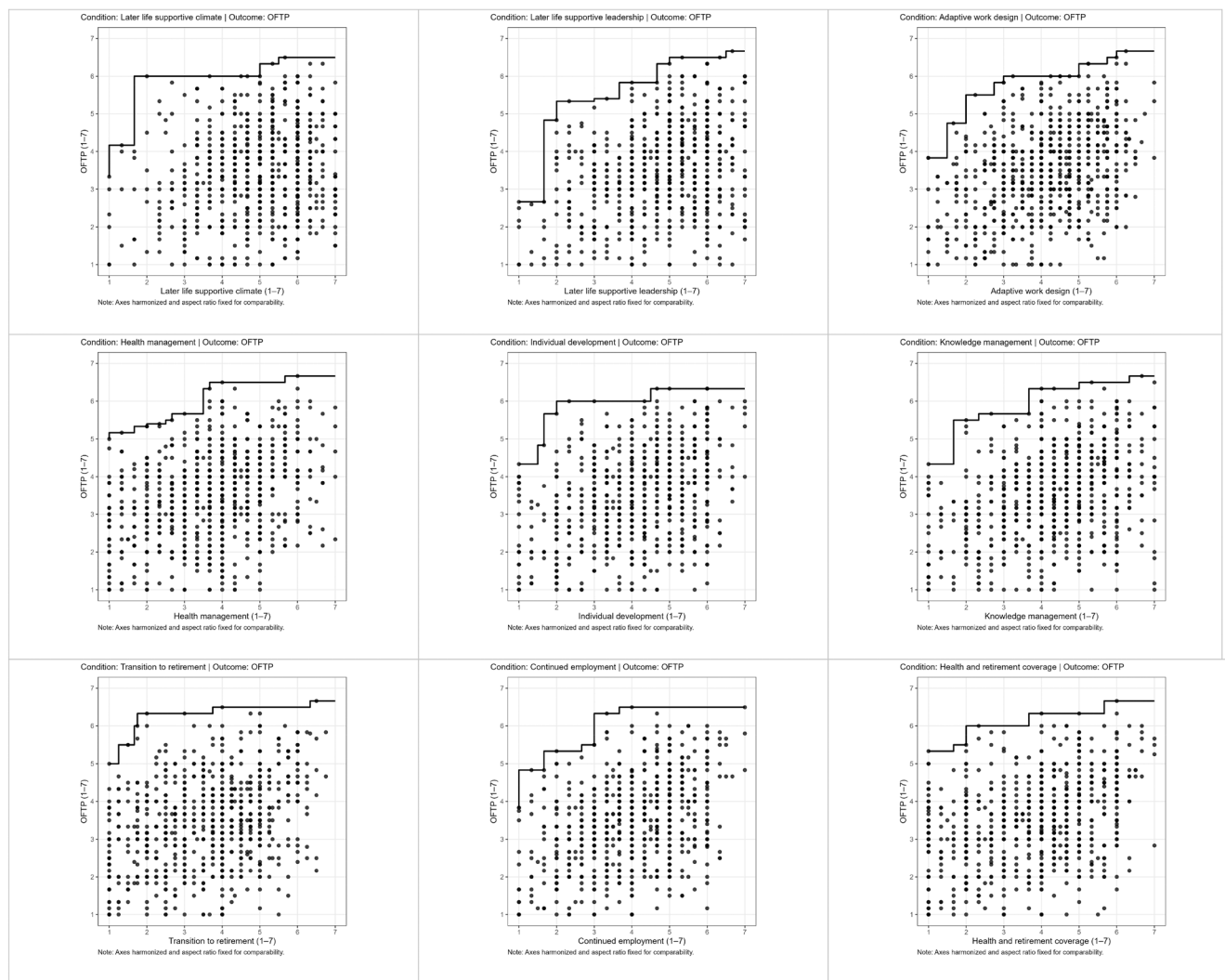


FIGURE 1 | (Continued)

domains, that are required for specific levels of the outcome, that is OFTP, among older workers. For instance, the bottleneck table shows that to achieve the maximum level of OFTP, the minimal viable levels of later life supportive climate, later life supportive leadership, and adaptive work design are 5.67, 6.33, and 4.75, respectively. When any of these HRM practices fall below the respective threshold, it is not typically possible to expand one's occupational time horizon (OFTP) to its maximum. Moreover, Table 3 shows that up to Level 5 of OFTP, later life supportive climate and leadership are not necessary, whereas adaptive work design must be at least 1.25. If an organization has a perceived level of adaptive work design lower than the threshold value of 1.25, older workers of such an organization cannot achieve the corresponding level of OFTP. Hence, to achieve Level 5 of OFTP, Level 1.25 of the adaptive work design is a bottleneck.

Under the above-mentioned decision rule, Hypothesis 1 receives partial support, indicating that two of the nine LLWI domains are typically necessary for an expanded OFTP and that the other domains represent “near necessity” effects in our total sample.

## 4.1 | Exploratory RQ

Our post hoc analysis compared the patterns of necessity between culturally Tight and Loose societies. Tables 2 and 3 and Figure 1 describe these patterns. Although NCA currently lacks a formal test for comparing effect size differences across groups, descriptive comparisons suggest that necessity effects were generally stronger in Tight societies. Specifically, seven out of the nine LLWI domains exhibited medium-sized necessity effects in Tight contexts (ranging from  $d=0.10$  to  $0.23$ ), whereas most effects in Loose contexts were smaller. These results provide exploratory evidence consistent with the idea that cultural tightness may amplify the necessity of organizational HRM resources, though definitive statistical verification is not yet possible.

Although the size effect variation in the Loose cluster was much smaller than in the Tight cluster ( $\Delta d=0.09$  vs.  $\Delta d=0.16$  in the Tight cluster), we found medium-sized effects of six domains (later life supportive climate, later life supportive leadership, adaptive work design, individual development, knowledge management, and continued employment), as well as small effects

Panel 3: Loose cluster

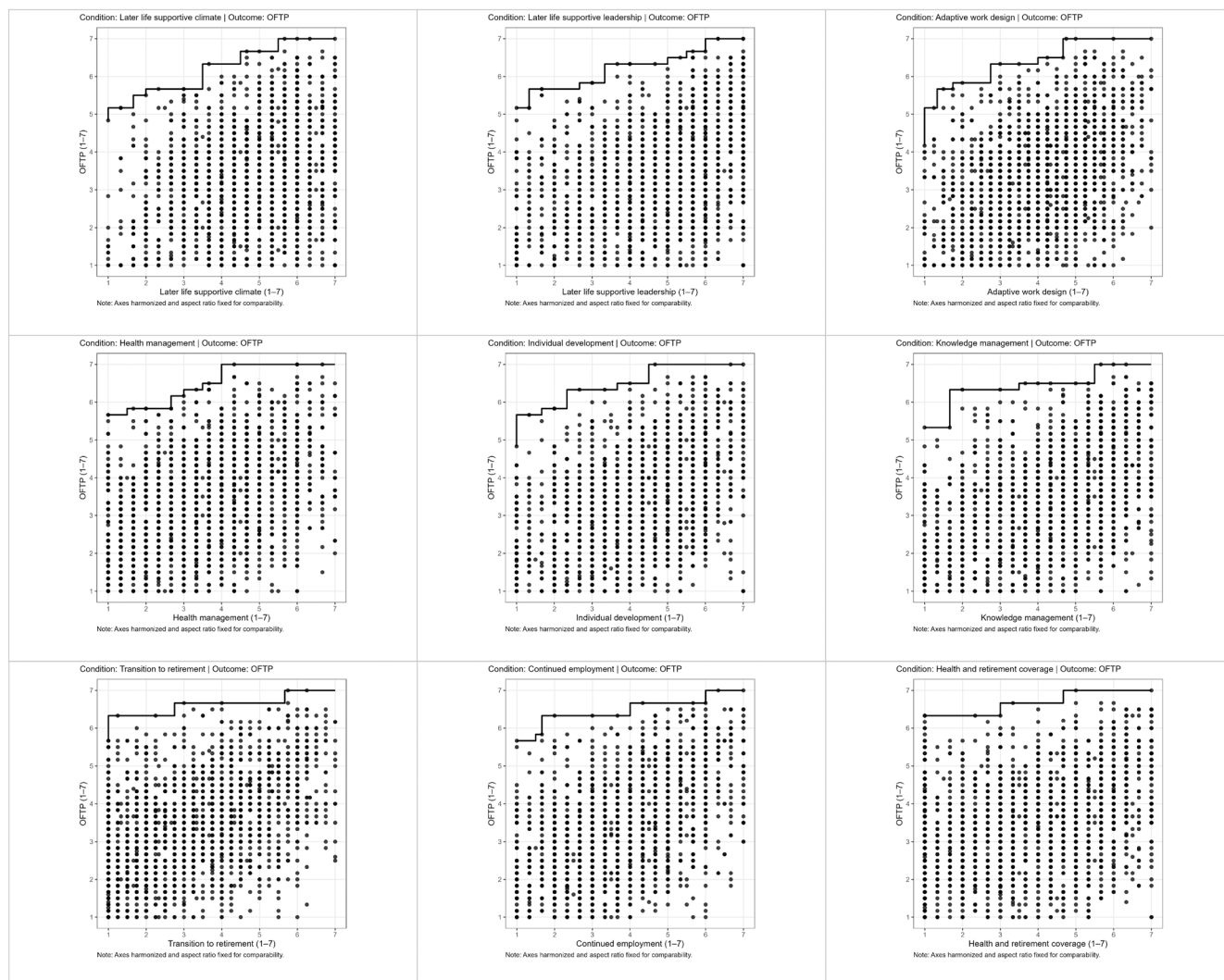


FIGURE 1 | (Continued)

of health management, transition to retirement, and health and retirement coverage on OFTP. All necessity effects were significant at the  $p < 0.05$  level or lower. Interestingly, the transition to retirement effect on OFTP was the same ( $d = 0.07$ ) in the two clusters and in the total sample, showing a consistent “near necessity” effect. The smallest effect found in the Tight cluster corresponds to the transition to retirement domain ( $d = 0.07$ ) and, in Loose societies, to the health and retirement coverage domain ( $d = 0.06$ ). Later life supportive leadership had the largest effect size of any domain of the organizational HRM practices in all samples. Figure 1 displays a clear visualization of this effect: it is in the later life supportive leadership  $\times$  OFTP scatter plots that we observe some of the largest empty areas in the plots’ upper-left corners.

Country-level analyses (Appendix A) confirmed that the overall necessity structure of the HRM practices is consistent across all nine nations. However, the strength of necessity varies somewhat by culture, highlighting that cultural heterogeneity remains within clusters. Specifically, effect sizes tended to be slightly higher in the culturally tighter countries (e.g., Japan, Poland, Norway) than in the looser ones (e.g., the U.S., the

Netherlands, Portugal, Italy, Belgium, Germany). This finding suggests that cultural tightness may amplify, but does not redefine, the core necessity pattern observed in the pooled data (Table A1; Figures A1–A9).

Having established that the LLWI domains are typically necessary for OFTP—exceptions being “near necessary” individual development and transition retirement domains in the Tight cluster, and health management, transition to retirement, and health and retirement coverage domains in the Loose cluster—thereby supporting the presence of necessity relationships in *kind*, we proceeded with the analysis of necessity relationships in *degree* between the LLWI domains and OFTP among older workers (Ding and Kuvaas 2025; Dul 2021; Vis and Dul 2018). Given that testing for a significant difference in the strength of a necessity effect comparing a specific group (e.g., the Tight cluster) with another group (e.g., the Loose cluster) is currently unavailable in NCA, analyzing necessity relationships in *degree* becomes even more relevant.

As theorized, our results support the assumption that LLWI domains are necessary for OFTP in the two clusters; that is to

TABLE 3 | Bottleneck table—total sample and per cluster.

| OFTP | Later life<br>supportive<br>climate |      |      | Later life<br>supportive<br>leadership |      |      | Adaptive<br>work design |      |      | Health<br>management |      |      | Individual<br>development |      |      | Knowledge<br>management |      |      | Transition to<br>retirement |      |      | Continued<br>employment |      |      | Health and<br>retirement<br>coverage |    |      |
|------|-------------------------------------|------|------|----------------------------------------|------|------|-------------------------|------|------|----------------------|------|------|---------------------------|------|------|-------------------------|------|------|-----------------------------|------|------|-------------------------|------|------|--------------------------------------|----|------|
|      | S                                   | T    | L    | S                                      | T    | L    | S                       | T    | L    | S                    | T    | L    | S                         | T    | L    | S                       | T    | L    | S                           | T    | L    | S                       | T    | L    |                                      |    |      |
| 1    | NN                                  | NN   | NN   | NN                                     | NN   | NN   | NN                      | NN   | NN   | NN                   | NN   | NN   | NN                        | NN   | NN   | NN                      | NN   | NN   | NN                          | NN   | NN   | NN                      | NN   | NN   |                                      |    |      |
| 2    | NN                                  | NN   | NN   | NN                                     | NN   | NN   | NN                      | NN   | NN   | NN                   | NN   | NN   | NN                        | NN   | NN   | NN                      | NN   | NN   | NN                          | NN   | NN   | NN                      | NN   | NN   |                                      |    |      |
| 3    | NN                                  | NN   | NN   | NN                                     | 2    | NN   | NN                      | NN   | NN   | NN                   | NN   | NN   | NN                        | NN   | NN   | NN                      | NN   | NN   | NN                          | NN   | NN   | NN                      | NN   | NN   |                                      |    |      |
| 4    | NN                                  | 1.33 | NN   | NN                                     | 2    | NN   | NN                      | 1.67 | NN   | NN                   | NN   | NN   | NN                        | NN   | NN   | NN                      | NN   | NN   | NN                          | NN   | 1.33 | NN                      | NN   | NN   |                                      |    |      |
| 5    | NN <sup>a</sup>                     | 2.00 | 1.33 | NN                                     | 2.33 | NN   | 1.25                    | 2.25 | 1.25 | NN                   | NN   | NN   | NN                        | 2.00 | 1.33 | NN                      | 2.00 | NN   | NN                          | NN   | 2.00 | NN                      | NN   | NN   |                                      |    |      |
| 6    | 1.67                                | 2.00 | 3.67 | 3.00                                   | 5.00 | 3.67 | 2.25                    | 3.25 | 3.00 | 2.67                 | 3.67 | 3.00 | 1.67                      | 2.33 | 2.67 | 1.67                    | 4.00 | 2.00 | 1.25                        | 1.75 | 1.25 | 1.33                    | 2.00 | NN   | 2.33                                 | NN |      |
| 7    | 5.67                                | NA   | 5.67 | 6.33                                   | NA   | 6.33 | 4.75                    | NA   | 4.75 | 4.33                 | NA   | 4.33 | 4.67                      | NA   | 4.67 | 5.67                    | NA   | 5.67 | 5.75                        | NA   | 5.75 | 6.33                    | NA   | 6.33 | 5.00                                 | NA | 5.00 |

Note: The first column refers to the OFTP levels.

Abbreviations: Loose, L; NA, non-applicable [in the Tight cluster, the maximum actual values, i.e., the values in the original dataset and the scatter plot of Y (OFTP), ranged from 6.33 to 6.67]; NN, not necessary; Tight, T; Total sample, S. In the total sample, some older workers reached OFTP = 5 without any level of later life supportive climate being necessary, yet in the Tight and Loose subsamples, a minimal supportive climate level was required for OFTP = 5. This discrepancy arises because different outlier cases were present (and removed) in each analysis. In the total sample, a few outliers with high OFTP, despite low supportive climate, remained (influencing the bottleneck). In the split samples, those specific cases were either absent or identified as outliers (hence the climate requirement showed up). This highlights how outlier removal and sample segmentation can impact the observed necessity thresholds, a nuance we handled by using a consistent outlier criterion across analyses (see the Table 3 table note).

say, as supposed, they hold under different contexts. Still, this is not enough to accurately portray the necessity relationships. To this end, the bottleneck table (see Table 3) provides us with critical insights for evaluating necessary conditions in *degree* (Dul 2021). Table 3 allows us to dig further into this issue by showing which levels of the domains are typically necessary or must be typically met for reaching certain levels of OFTP. For instance, a close inspection of the bottleneck table shows that to achieve a Level of 5 for OFTP, the later life supportive leadership level must be at least 2.33 in Tight societies. In contrast, later life supportive leadership is not necessary for Loose societies. The same profile can be found regarding knowledge management and continued employment, with a threshold of 2 for Level 5 for OFTP to be possible in Tight societies, while not being necessary in the Loose cluster.

Even for lower levels of OFTP (Level 4), there are minimal viable levels of later life supportive climate and adaptive work design of 1.33 and 1.67 to achieve that level of OFTP, respectively, but again, only in the Tight Cluster. In contrast, these two domains are not necessary for older workers to achieve a Level 4 for OFTP in Loose societies. Moreover, when LLWI domains are necessary conditions for achieving the same level of OFTP in both clusters, our results show that the threshold level that must typically be met in Tight societies is higher than in Loose ones. For example, to achieve Level 5 for OFTP, a Level 2.00 and a Level 1.33 for individual development are needed in Tight and Loose societies, respectively. Level 6 for OFTP is possible when health management in Tight societies is at least 3.67 vs. only 3.00 in Loose societies, with the transition to retirement domain threshold in Tight societies being 1.75 versus 1.25 in Loose societies. To achieve Level 6 for OFTP, a perceived provision of health and retirement coverage of 2.33 is typically necessary, but only in Tight societies. This LLWI domain is not needed to reach that same level of OFTP in Loose societies.

Overall, the data in the bottleneck table (see Table 3) indicate a higher degree of necessity of LLWI domains for an expanded OFTP in Tight societies. For almost all OFTP levels, LLWI domains are needed at a higher level in Tight societies than in Loose ones (exceptions are the later life supportive leadership and individual development domains for Level 6 of OFTP). Furthermore, in other levels of OFTP, for example, Level 5, LLWI domains like later life supportive leadership, knowledge management, and continued employment were only necessary in the Tight cluster. At the same time, they were not necessary in the Loose cluster. These findings partially support the idea that the degree of typically necessary LLWI domains for an expanded OFTP is higher in Tight societies than in Loose societies.

## 5 | Discussion

### 5.1 | Findings and Implications for Theorizing and Research

This paper adds to the literature by investigating *which* and to *what* degree age-related HRM practices (LLWI domains) are necessary to extend older workers' working lives by examining their relationship with OFTP.

Consistent with our predefined criterion of  $d \geq 0.10$ , the empirical evidence in our scholarly work offers partial support for Hypothesis 1. Although two LLWI domains surpassed this threshold, several others fell slightly below it. We interpret these sub-threshold effects as indicative of “near necessity” in degree (Dul et al. 2023): they constrain OFTP to a meaningful extent even while they do not strictly meet the binary requirement. In general, our findings suggest that all the age-related HRM practices (LLWI domains) examined are necessary or “near necessary” for an extended OFTP. By showing that multiple HRM practices are necessary for OFTP, we add to existing probabilistic findings in the business context (e.g., Rudolph et al. 2018). In doing so, we also confirm and extend the propositions of CoR theory (Hobfoll 1989) in the context of aging. According to CoR theory, individuals need to invest resources to gain new ones, and the more resources they have access to, the easier it is to acquire new resources. We extend this presumption by indicating that when the organization provides resources in the form of age-inclusive HRM practices, this can enable an increase in personal resources such as a prolonged OFTP, presumably via a resource spiral in which resources provided by HRM practices (e.g., working time flexibility as an aspect of adaptive work design or development opportunities) translate into personal resources such as time, energy or knowledge. More importantly, by showing that distinct values for resources (e.g., later life supportive leadership or adaptive work design<sup>3</sup>) are needed to reach a certain extent of OFTP, we add to CoR's proposition that certain thresholds of resource investment are necessary to build new resources.

Our analyses also show that later life supportive leadership and adaptive work design are the HRM practices with the strongest necessity effects on OFTP among older workers. Work design defines the resources and demands older workers face at work, and it is well established that they are important for OFTP (e.g., Rudolph et al. 2018). Also, it is the supervisor who has the power to accommodate the working conditions of older workers in terms of resources and demands in response to their needs. With our findings, we add to this literature stream by showing that these HRM practices are necessary to prolong older workers' participation in the workforce, as indicated by an extended OFTP.

Regarding our RQ, we approached the cultural comparison descriptively rather than confirmatory. Because NCA lacks a formal statistical function for comparing necessity effect sizes across groups, we treated observed cross-cultural differences as exploratory patterns. Our results tentatively suggest that necessity effects are stronger in Tight societies, but these findings should be interpreted as propositions for future empirical testing rather than as confirmed hypotheses.

The Cultural Anchors or Ageism theory posits that culture affects individuals' vulnerability to ageism and—hence—stresses the necessity of age-related interventions to overcome potential ageism (Marcus and Fritzsche 2016; Marcus et al. 2020). Therefore, to fully grasp how HRM practices are critical for OFTP, cultural context needs to be factored in, with the cultural T-L dimension being particularly relevant in the context of aging at work (Marcus and Fritzsche 2016). Tight cultures are characterized by strong norms with little tolerance for deviation; thus,

both the kind and degree of typically necessary LLWI domains for an expanded OFTP may differ from those in Loose cultures.

Indeed, in loose societies, a later life supportive climate had the highest necessity effect on OFTP. Organizational climate refers to all standards and actions that foster equal opportunities and a positive image for all age groups, including older workers (i.e., workers before and in retirement age; Finsel et al. 2023), which significantly impacts their job-related well-being and work ability (Wilckens et al. 2021). The findings in the present study show that only when workers perceive organizations to value non-discriminatory treatment and equal opportunities for older workers (Boehm et al. 2014) is it possible for them to invest in long-term career planning within that organization. Thus, it not only supports but also extends the findings of earlier (probabilistic) studies that pointed out the critical role of organizational supportive climate regarding age (Henry et al. 2017).

Although LLWI practices are typically necessary, the degree of necessity varies according to culture. Generally, it is higher in Tight societies than in Loose ones. Using the most critical necessity domain (later life supportive leadership) as an example, in Tight societies, leaders might be expected to coach older workers to address their personal needs and to allow opportunities for their professional development (Finsel et al. 2024). On the contrary, in Loose societies that are characterized by more individualism and autonomy, leaders may be considered less responsible for enabling older workers to decide on their career paths and, hence, their OFTP.

Another example is the HR practice of adaptive work design, which the present study shows to be critical for older workers' OFTP, particularly in Tight societies. Adaptive work design refers to the (re)design of work roles and responsibilities, such as adaptations of work location, time, and physical space to fit the needs of older workers and calls for the responsibility of organizational executives to harness the potential of workers of all ages to be successful. Indeed, aligning employment practices, such as training, with work practices, such as job redesign, is a promising strategy for achieving positive outcomes at multiple organizational levels (Tafvelin et al. 2018). Finsel et al. (2024) recently also showed that leader-employee perceptual congruence on high levels of perceived age-friendly work design was related to higher levels of employee well-being.

In summary, the findings of the present study showed that the degree of necessity of HRM activities was generally higher in Tight societies than in Loose societies. This suggests that the “minimal viable HRM practices” *must* be implemented in a more well-thought-out and integrated way to allow an extended OFTP among older workers in Tight societies. Not only can the highest risk of ageism be registered in Tight cultures (Marcus and Fritzsche 2016), but—as expected—the *degree* of typically necessary LLWI domains for an expanded OFTP is higher in Tight societies than in Loose societies, particularly at lower levels of OFTP. For instance, to reach Level 4 of OFTP in Tight societies, minimal levels need to be reached for four domains, whereas no single domain is needed in Loose societies. Interestingly, the higher the level of OFTP one aims to reach, the higher thresholds are typically needed for any of these nine LLWI domains, and—relatedly—the more

domains need to reach a minimum threshold, even in Loose societies. Indeed, six domains were needed to reach Level 5 of OFTP in Tight societies and three for Loose societies; nine domains were needed in Tight societies to reach Level 6 of OFTP and eight in Loose societies. These findings are in line with well-established knowledge about high-performance work practices in HR (Huselid 1995). Specifically, high investment in HR practices pays off for both organizations and individual workers (Huselid 1995), and particularly in retaining high performers (Kwon et al. 2024).

Our findings reinforce Principle 2 of CoR theory, which states that individuals must invest resources to prevent loss and achieve further gains (Hobfoll 1989, 2001; Hobfoll et al. 2018). The necessity logic inherent in CoR theory helps explain why each LLWI domain constitutes an essential rather than optional resource for sustaining older workers' OFTP. In practice, this means that when organizations fail to provide critical later-life HRM supports, older workers cannot compensate through other resources or favorable conditions. This pattern aligns with the necessity logic formalized by NCA (Dul 2021, 2024a), highlighting that extended working lives depend on meeting specific "must-have" resource thresholds rather than accumulating additional advantages.

In a nutshell, all nine LLWI domains of HR practices are typically necessary for OFTP, and it is harder to reach higher levels of OFTP in Tight societies than in Loose ones. Put differently, organizations in Tight societies must invest more intensively in these HRM practices as critical organizational resources to buffer against older workers getting stuck. This endeavor may be harder but more necessary in Tight societies than in Loose societies. These insights are both theoretically and practically relevant as they might guide organizations in deciding on their HR policies, choosing the practices that are necessary for allowing minimal OFTP levels, and taking into consideration contextual boundaries, like the T-L of their cultures.

## 5.2 | Implications for Practice

The findings of this study offer several valuable insights for HR professionals, organizational leaders, and policymakers seeking to extend older workers' OFTP and, ultimately, their participation in the workforce. Most importantly, the results show that all nine domains of age-related HRM practices—conceptualized through the LLWI framework—are not only beneficial but *necessary* to achieve extended OFTP. This enhanced understanding underscores the need for organizations to adopt a comprehensive and integrated approach to age-inclusive HRM, rather than implementing isolated initiatives.

For practitioners, this means that they should first prioritize practices such as later life supportive leadership and thoughtful adaptive work design, including adjustments in work location, time, and physical setup. These two domains emerged as particularly critical, highlighting the key role of managers and direct supervisors in shaping supportive environments that enable older workers to remain engaged and productive. By showing their older workers' appreciation and enabling them ample decision latitude to organize work tasks in ways that balance

their resources and demands to fit their capabilities, the aim is to result in a reasonable work-leisure time ratio. In general, implementing LLWI domains is necessary to enhance the career sustainability of older workers, as OFTP is an important HRM concept predictive of work engagement, retirement intentions, and task performance (Henry and Desmette 2018; Rudolph et al. 2018).

Second, this study shows that six additional HRM strategies are necessary to achieve extended OFTP levels among aging workers. However, the impact of their absence is weaker than that of later life supportive leadership and adaptive work design. Later life supportive climate should allow for equal opportunities regardless of workers' age, provide positive attitudes towards older workers, and allow age to be talked about freely. Workers' individual development should be secured by mapping their qualifications, facilitating competence development, and adapting work to their skills. Knowledge management should secure the transfer of knowledge between generations and systematic knowledge sharing. Health management must be ergonomically designed, physical activity and healthy lifestyles encouraged, and medical treatment and stress management provided when needed. Smooth transitions to retirement should include joint planning between the leader and the worker, adaptation to individual needs, counseling and assistance in readjustments, and active contact with the workers after their retirement. Finally, the employer should have clear and documented strategies for continued employment after retirement, adapt working hours and tasks for workers wanting a reduced workload before full retirement, and recruit older workers (a comprehensive view of all LLWI domains is available in Appendix B). Previous studies have identified similar dimensions as important predictors of extended working careers for aging workers; however, our scholarly work provides a comprehensive model of strategies that are *necessary* for older workers' OFTP levels.

Third, our findings also indicate that the necessity of specific HRM practices is not uniform across all cultural contexts. Ageism differs between cultures (Marcus and Fritzsche 2016; Marcus et al. 2020). Hence, as expected, this study shows that certain HRM practices regarding older workers are *typically more necessary* in some cultures than in others, which is important for HRM both in national and multinational companies and consistent with a necessary-supply fit perspective to make the best possible use of HRM practices (Hauff et al. 2021; Van Beurden et al. 2022). Particularly, in Tight cultures characterized by strong norms with little tolerance for deviation, the degree of necessary LLWI-based HRM practices for an expanded OFTP is typically higher than in Loose cultures. In Tight cultures, all LLWI-based HRM practices are necessary to obtain high OFTP levels for older workers, and later life supportive leadership, adaptive work design, and knowledge management appear to have the strongest impacts, followed by later life supportive climate, health management, opportunities for continued employment, and health and retirement coverage.

Compared to Tight cultures, in Loose cultures, the HRM strategies with the strongest necessity effects are later life supportive climate and leadership, followed by adaptive work design,

individual development, knowledge management, continued employment, and health management. In contrast, health and retirement coverage has a marginal necessity effect. This cultural nuance has clear practical relevance: organizations operating in tight cultures need to invest more heavily in coordinated, multi-domain HR strategies to support older workers and counteract stronger ageist norms successfully.

Fourth, organizations who are interested in enabling their older workers' OFTP and consequently prolonged work engagement and sustainable careers could use the LLWI-SF to assess the status of their HRM practices and, depending on their cultural context, need to pay special attention to its adoption by not only investing more in the improvement of such practices but also a broader implementation across more LLWI domains. This reinforces earlier findings from the high-performance HRM literature and signals to organizations that supporting older workers is not a marginal or optional initiative. It rather requires intentional, sustained resource allocation. The LLWI-SF status quo assessment can function as a starting point to tailor the specific necessary HRM practices to extend OFTP among older workers.

Finally, these insights offer valuable guidance for policymakers aiming to foster more age-inclusive labor markets and design targeted interventions that support longer working lives. Policy incentives encouraging organizations to adopt evidence-based HRM practices, particularly in more culturally constrained contexts, could be a strategic lever to help address demographic shifts and sustainably extend working lives.

In sum, supporting older workers' long-term engagement in the labor force, and thereby their career sustainability, demands a strategic, culturally aware, and well-resourced HRM approach. Organizations that do so effectively stand to benefit from the retention, experience, and contributions of an increasingly vital segment of the global workforce.

### 5.3 | Limitations and Recommendations for Future Research

This study did not explain the causes of the observed phenomena. Therefore, in the future, combining NCA with other traditional sufficiency methods of analysis (e.g., Structural Equation Modeling) may yield a holistic and comprehensive analysis that enables us to gain a more in-depth insight into sound HRM practices for older workers, adjusted to specific organizational, social, and cultural contexts. Furthermore, given that T-L is a continuous rather than a dichotomous variable, our two-cluster approach inevitably masks some within-cluster variation. Future studies should analyze necessity relationships using continuous cultural scores or within-country longitudinal data to capture dynamic cultural and organizational effects more precisely.

Besides, as we treated OFTP as one overall construct, future research should explore whether there are differences in relationship strengths comparing the two OFTP dimensions (i.e., focus on opportunities and perceived remaining time; Zacher and Frese 2009) and their antecedents (Henry and Desmette 2018; Rudolph et al. 2018). In addition, this study presents the OFTP

as a dynamic construct, meaning that the OFTP can change over time, influenced by the signals individuals receive from their environment (Connelly et al. 2011). It shows that signals received from the environment through HRM practices for older workers (covered by LLWI domains) influence their perceptions of the occupational future. Further research should identify the mechanisms of this impact, in particular, the role of the social identity and self-esteem of older workers in the relationships between the nine LLWI domains of LLWI and OFTP, particularly because OFTP (necessary condition outcome) can also be caused by the degree to which older workers identify with their group (Zacher et al. 2018) as well as their self-esteem. Moreover, it is also advisable to conduct longitudinal studies showing how OFTP changes over time under the impact of LLWI domains. Furthermore, comparing the results of NCA with the results of qualitative comparative analysis (QCA) (Thomann and Maggetti 2020) would enable us to explain more comprehensively the effect of LLWI domains on OFTP, as the latter focuses on "deterministic sufficiency" (Dul 2024a, 2).

Additionally, our results suggest the presence of a resource spiral process that relates age-inclusive HRM practices to personal resources such as prolonged OFTP. However, future research will need to shed more light on the actual gain spiral process we propose based on our findings and demonstrate whether the idea of necessity thresholds for resource building holds across other contexts as well.

Our findings have laid the foundation for establishing practical recommendations to enhance the ability of working organizations to promote HRM practices tailored to the needs of a specific age group and the cultural characteristics of a particular society. However, it would be useful to consider another typology of national cultures and its inherent dimensions (e.g., the GLOBE project; House et al. 2004) and compare the results with the outcomes of our study. It would make it possible to disclose the necessary HRM practices for older workers in a variety of national cultures. In this context, it is also worth mentioning that further studies could explore the full matrix of Marcus and Fritzsche's (2016) model, which would require data from more countries to represent the four clusters properly and to avoid confounding culture and country.

It should also be noted that the results obtained at the national level are unrepresentative due to the sampling method applied. Consequently, conducting future research on a random sample is even more important because, despite the measures taken to increase the reliability of the results obtained (e.g., the permutation tests), our sample was not a probability sample, and its results cannot be generalized. Furthermore, it is worth noting that the LLWI and OFTP data were collected from the same sources, namely, workers, which raises the possibility of common-method bias (Podsakoff et al. 2012). In the future, the use of multiple sources of data (e.g., actual provision of LLWI practices rather than perceived provision) would increase the reliability of the results. Finally, future research could explore alternative cut-off values for  $d$  (e.g., 0.05 or 0.15) to test the robustness of necessity conclusions, as recommended by Dul et al. (2023).

In summary, the fundamental strength of this study lies in its unique perspective on the necessary HRM practices required to

extend the OFTP of mature workers, taking into account cultural characteristics, thereby increasing the likelihood of the success of organizational enablers of sustainable careers.

## 6 | Conclusion

An expanded OFTP is only expected when each LLWI domain meets or exceeds its necessity threshold; falling short on any domain markedly reduces the likelihood of expanded OFTP, and strengths elsewhere cannot compensate for that shortfall. Consequently, our study has important managerial implications, even more so when organizational HRM practices may differ in their effectiveness in extending OFTP across cultures. The necessity perspective demonstrated here can be implemented in various research fields because many other phenomena include necessary conditions whose absence can prevent a desired outcome. Our study adopts NCA, thereby ensuring theory-method fit, which is crucial to identify critical factors required for achieving specific outcomes that traditional methods might overlook (Aguinis et al. 2020), and shows the importance of necessity theorizing to understand the essential elements to develop high levels of OFTP. Against most HRM research's "current paucity of policy implications" (Aguinis et al. 2022, 872), our findings may stir policies in HRM topics such as later life supportive leadership, adaptive work design development, and diversity and inclusion.

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### Conflicts of Interest

The authors declare no conflicts of interest.

### Data Availability Statement

The data that support the findings of this study are available from the corresponding author upon reasonable request.

### Endnotes

<sup>1</sup> For the sake of construct clarity, three original LLWI dimensions were renamed: organizational climate was renamed into later life supportive climate; leadership was renamed as later life supportive leadership, and work design was renamed into adaptive work design.

<sup>2</sup> Although the use of bold font was not included in the citations, we have used it in this section to stress the line of reasoning.

<sup>3</sup> Although the LLWI domains are moderately inter-correlated ( $r = 0.60 - 0.75$ ), NCA isolates their non-compensatory contribution: even correlated practices can form unique bottlenecks that restrict extended

working lives when they fall below minimal thresholds. This means that multicollinearity does not invalidate the necessity findings but indicates that certain domains particularly later-life supportive leadership and adaptive work design are simultaneously central and non-substitutable.

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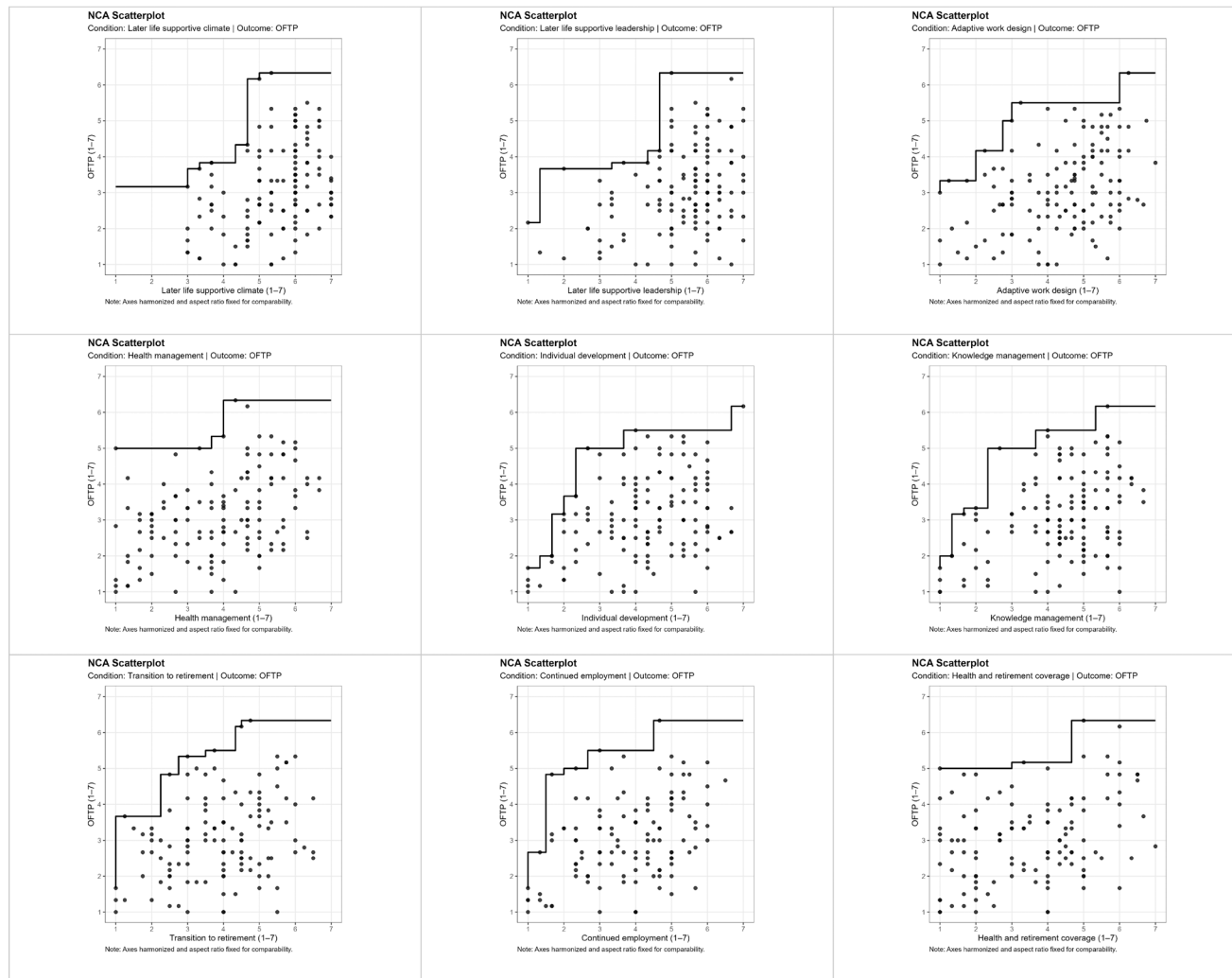
## Appendix A

TABLE A1 | Necessary conditions analyses per country.

| Conditions                          | OFTP    |         |         |         |         |                 |         |          |         |
|-------------------------------------|---------|---------|---------|---------|---------|-----------------|---------|----------|---------|
|                                     | Norway  | Poland  | Japan   | US      | Italy   | the Netherlands | Germany | Portugal | Belgium |
| 1. Later life supportive climate    | 0.24*** | 0.15†   | 0.23*** | 0.21*** | 0.22*** | 0.24***         | 0.41*** | 0.17***  | 0.08    |
| 2. Later life supportive leadership | 0.37*** | 0.25*** | 0.24*** | 0.24*** | 0.12*** | 0.20***         | 0.33*** | 0.05     | 0.10    |
| 3. Adaptive work design             | 0.26*** | 0.11*   | 0.27*** | 0.20*** | 0.00    | 0.18***         | 0.36*** | 0.05     | 0.08    |
| 4. Health management                | 0.14    | 0.10*** | 0.17*** | 0.20*** | 0.06*** | 0.16***         | 0.21*** | 0.04     | 0.14*** |
| 5. Individual development           | 0.32*** | 0.11*** | 0.17*** | 0.23*** | 0.05*   | 0.17*           | 0.25*** | 0.06†    | 0.10†   |
| 6. Knowledge management             | 0.29*** | 0.15*** | 0.12*   | 0.20*** | 0.00    | 0.18***         | 0.23*** | 0.13***  | 0.06    |
| 7. Transition to retirement         | 0.23*** | 0.05    | 0.10†   | 0.12*** | 0.00    | 0.17***         | 0.13*** | 0.03*    | 0.02    |
| 8. Continued employment             | 0.21*   | 0.16*** | 0.15*   | 0.22*** | 0.07*** | 0.10†           | 0.20*** | 0.01     | 0.03    |
| 9. Health and retirement coverage   | 0.16*   | 0.08*   | 0.13*   | 0.19*** | 0.00    | 0.10***         | 0.18*** | 0.03*    | 0.00    |

Note: † $p < 0.10$  (marginally significant) \* $p < 0.05$  \*\* $p < 0.01$  \*\*\* $p < 0.001$ . Outliers that changed—increased or decreased—the original effect size by 20% or more were removed. NCA effect size thresholds (Dul 2016): small:  $0 < d < 0.10$ ; medium:  $0.10 \leq d < 0.30$ ; large:  $0.30 \leq d < 0.50$ ; very large:  $d \geq 0.50$ .

## Country: Norway



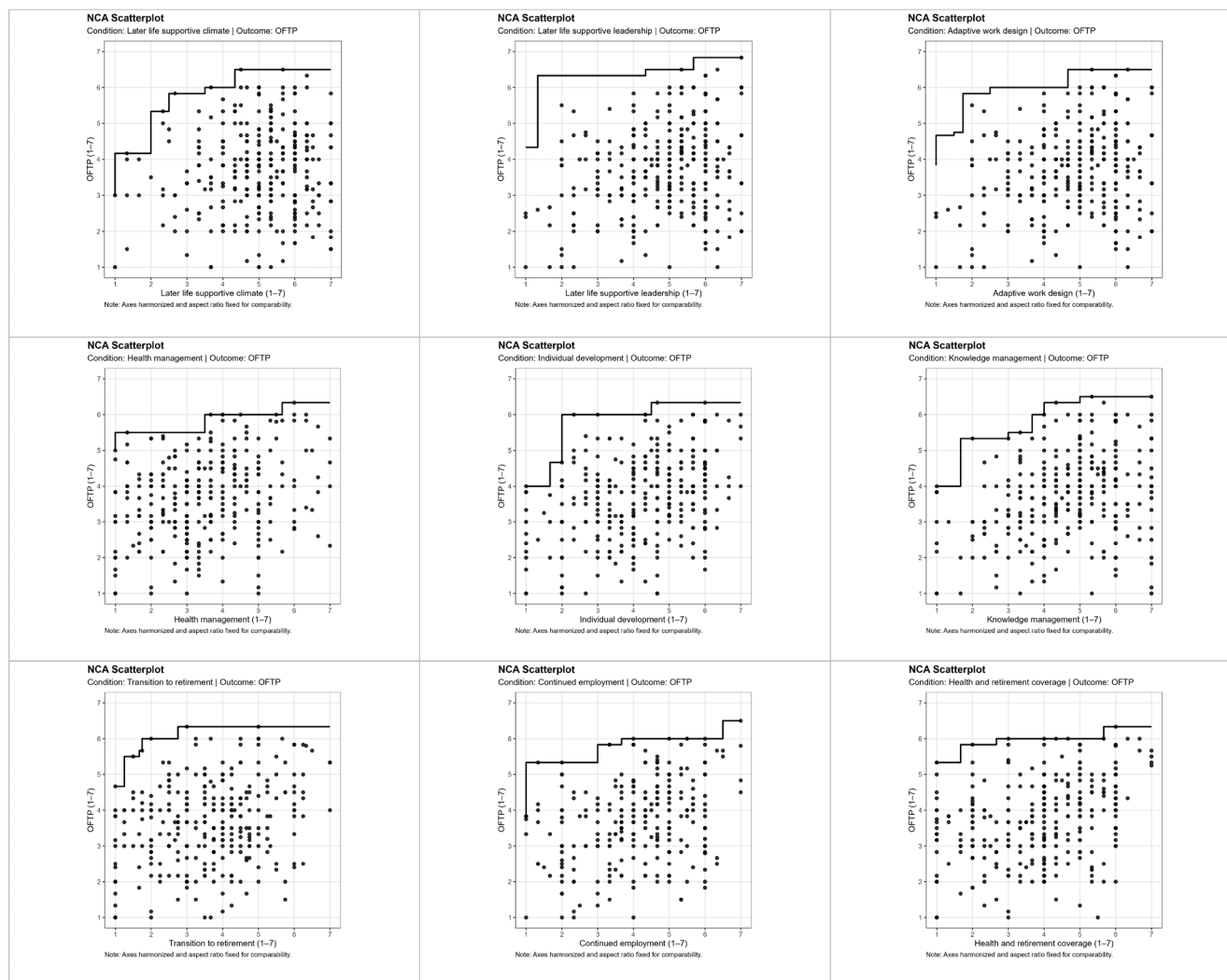
## Bottleneck Table – Norway

|             | Later life supportive climate | Later life supportive leadership | Adaptive work design | Health management | Individual development | Knowledge management | Transition to retirement | Continued employment | Health and retirement coverage |
|-------------|-------------------------------|----------------------------------|----------------------|-------------------|------------------------|----------------------|--------------------------|----------------------|--------------------------------|
| <b>OFTP</b> |                               |                                  |                      |                   |                        |                      |                          |                      |                                |
| 1           | NN                            | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 2           | NN                            | NN                               | NN                   | NN                | 1.67                   | 1.33                 | 1.25                     | 1.33                 | NN                             |
| 3           | NN                            | 2.00                             | NN                   | NN                | 2.00                   | 1.67                 | 1.25                     | 1.67                 | NN                             |
| 4           | 4.67                          | 4.67                             | 2.25                 | NN                | 2.67                   | 2.67                 | 2.50                     | 1.67                 | NN                             |
| 5           | 5.00                          | 5.00                             | 3.00                 | NN                | 2.67                   | 2.67                 | 3.00                     | 2.33                 | NN                             |
| 6           | 5.00                          | 5.00                             | 6.25                 | 4.33 <sup>a</sup> | 7.00                   | 5.67                 | 4.50                     | 4.67                 | 5.00                           |
| 7           | NA                            | NA                               | NA                   | NA                | NA                     | NA                   | NA                       | NA                   | NA                             |

Note. <sup>a</sup> Non-significant effect. The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

**FIGURE A1** | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

Country: Poland



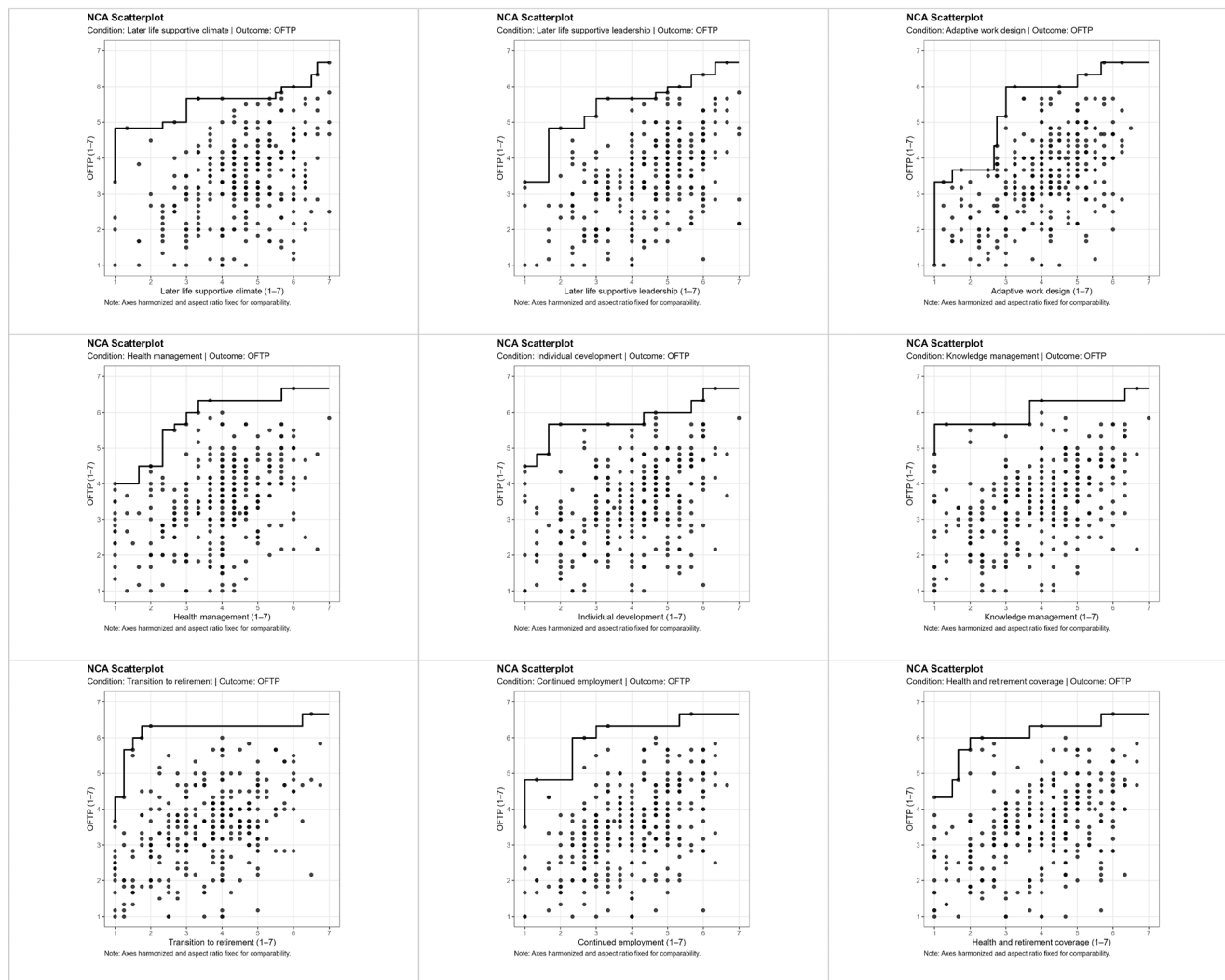
Bottleneck Table – Poland

|      | Later life supportive<br>climate | Later life supportive<br>leadership | Adaptive work<br>design | Health management | Individual<br>development | Knowledge<br>management | Transition to<br>retirement | Continued<br>employment | Health and retirement<br>coverage |
|------|----------------------------------|-------------------------------------|-------------------------|-------------------|---------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|
| OFTP |                                  |                                     |                         |                   |                           |                         |                             |                         |                                   |
| 1    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| 2    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| 3    | NN                               | 2.00                                | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| 4    | 1.33                             | 2.00                                | 1.50                    | NN                | NN                        | NN                      | NN                          | 1.33                    | NN                                |
| 5    | 2.33                             | 2.00                                | 2.00                    | NN                | 2.33                      | 2.00                    | 1.50 <sup>a</sup>           | 1.33                    | NN                                |
| 6    | 3.67                             | 5.00                                | 2.67                    | 3.67              | 2.33                      | 4.00                    | 2.00 <sup>a</sup>           | 4.00                    | 3.00                              |
| 7    | NA                               | NA                                  | NA                      | NA                | NA                        | NA                      | NA                          | NA                      | NA                                |

Note. <sup>a</sup> Non-significant effect. The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

FIGURE A2 | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

Country: Japan



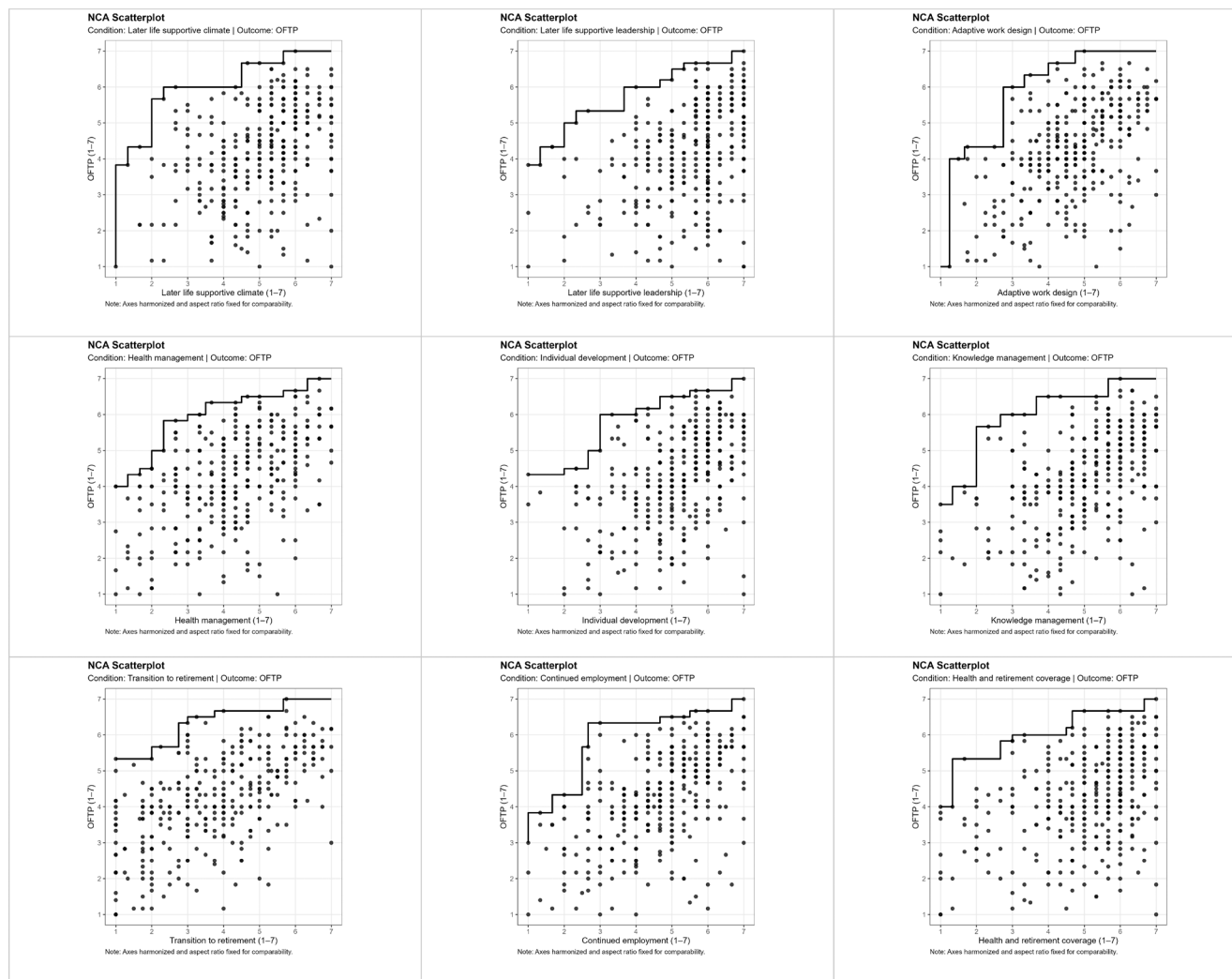
Bottleneck Table – Japan

|             | Later life supportive<br>climate | Later life supportive<br>leadership | Adaptive work<br>design | Health management | Individual<br>development | Knowledge<br>management | Transition to<br>retirement | Continued<br>employment | Health and retirement<br>coverage |
|-------------|----------------------------------|-------------------------------------|-------------------------|-------------------|---------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|
| <b>OFTP</b> |                                  |                                     |                         |                   |                           |                         |                             |                         |                                   |
| <b>1</b>    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>2</b>    | NN                               | NN                                  | 1.25                    | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>3</b>    | NN                               | NN                                  | 1.25                    | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>4</b>    | 1.33                             | 2.00                                | 2.75                    | NN                | NN                        | NN                      | 1.25                        | 1.33                    | NN                                |
| <b>5</b>    | 2.67                             | 3.00                                | 3.00                    | 2.67              | 2.00                      | 1.33                    | 1.50                        | 2.67                    | 2.00                              |
| <b>6</b>    | 6.00                             | 5.33                                | 3.25                    | 3.33              | 4.67                      | 4.00                    | 1.75                        | 2.67                    | 2.33                              |
| <b>7</b>    | NA                               | NA                                  | NA                      | NA                | NA                        | NA                      | NA                          | NA                      | NA                                |

*Note.* The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

**FIGURE A3** | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

Country: US



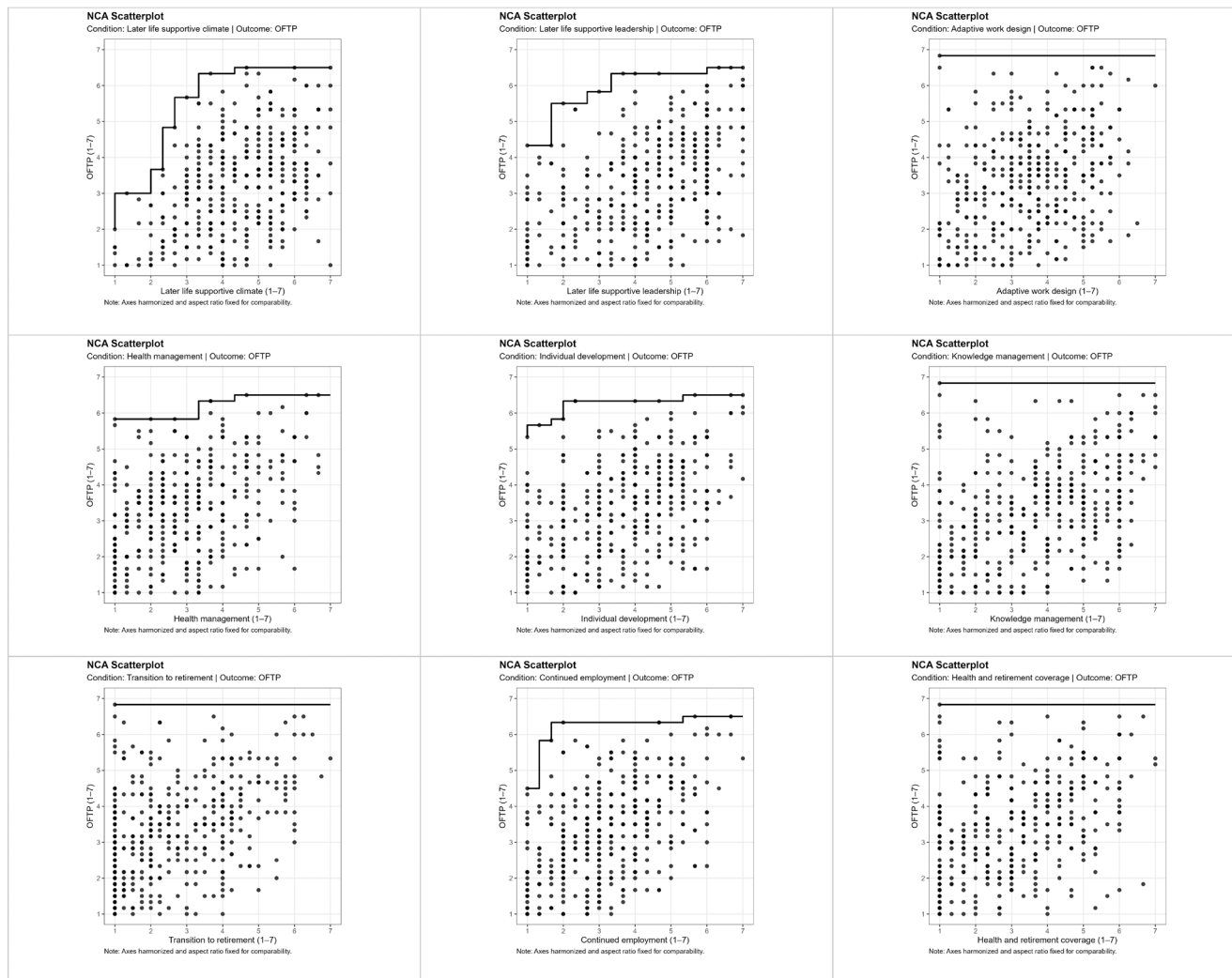
Bottleneck Table – US

|      | Later life supportive climate | Later life supportive leadership | Adaptive work design | Health management | Individual development | Knowledge management | Transition to retirement | Continued employment | Health and retirement coverage |
|------|-------------------------------|----------------------------------|----------------------|-------------------|------------------------|----------------------|--------------------------|----------------------|--------------------------------|
| OFTP |                               |                                  |                      |                   |                        |                      |                          |                      |                                |
| 1    | NN                            | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 2    | 1.33                          | NN                               | 1.50                 | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 3    | 1.33                          | NN                               | 1.50                 | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 4    | 1.67                          | 1.67                             | 1.50                 | NN                | NN                     | 1.67                 | NN                       | 2.00                 | NN                             |
| 5    | 2.33                          | 2.33                             | 3.00                 | 2.33              | 3.00                   | 2.33                 | NN                       | 2.67                 | 1.67                           |
| 6    | 2.67                          | 4.00                             | 3.00                 | 3.33              | 3.33                   | 3.00                 | 3.00                     | 3.00                 | 3.33                           |
| 7    | 6.00                          | 7.00                             | 7.00                 | 6.67              | 7.00                   | 6.00                 | 5.75                     | 7.00                 | 7.00                           |

Note. The first column refers to the OFTP levels. Abbreviations: NN = not necessary.

FIGURE A4 | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

Country: Italy



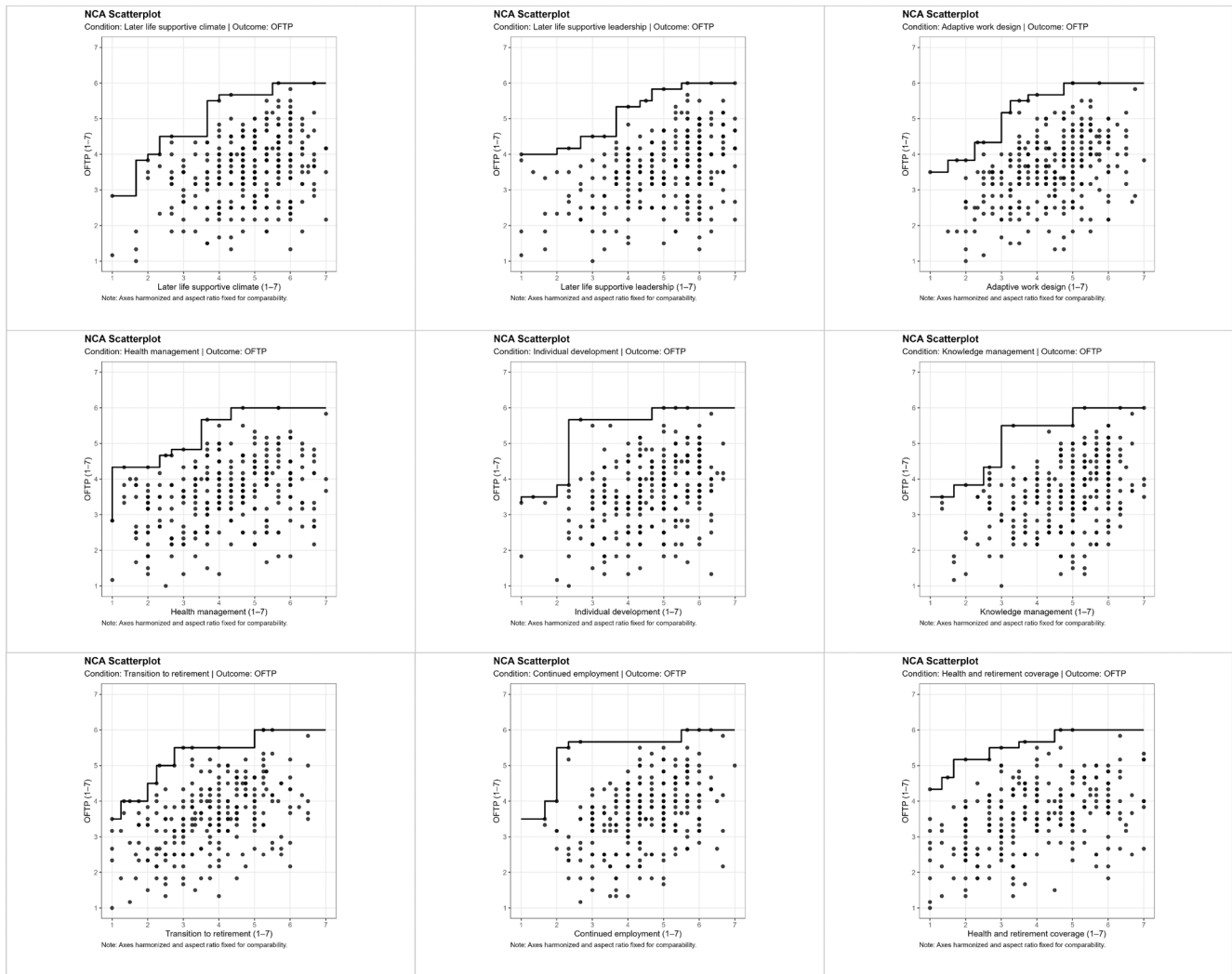
Bottleneck Table – Italy

|             | Later life supportive<br>climate | Later life supportive<br>leadership | Adaptive work<br>design | Health management | Individual<br>development | Knowledge<br>management | Transition to<br>retirement | Continued<br>employment | Health and retirement<br>coverage |
|-------------|----------------------------------|-------------------------------------|-------------------------|-------------------|---------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|
| <b>OFTP</b> |                                  |                                     |                         |                   |                           |                         |                             |                         |                                   |
| <b>1</b>    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>2</b>    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>3</b>    | 1.33                             | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>4</b>    | 2.67                             | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>5</b>    | 3.00                             | 2.00                                | NN                      | NN                | NN                        | NN                      | NN                          | 1.67                    | NN                                |
| <b>6</b>    | 3.67                             | 3.67                                | NN                      | 3.67              | 2.33                      | NN                      | NN                          | 2.00                    | NN                                |
| <b>7</b>    | NA                               | NA                                  | NN                      | NA                | NA                        | NN                      | NN                          | NA                      | NN                                |

*Note.* The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

**FIGURE A5** | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

Country: The Netherlands



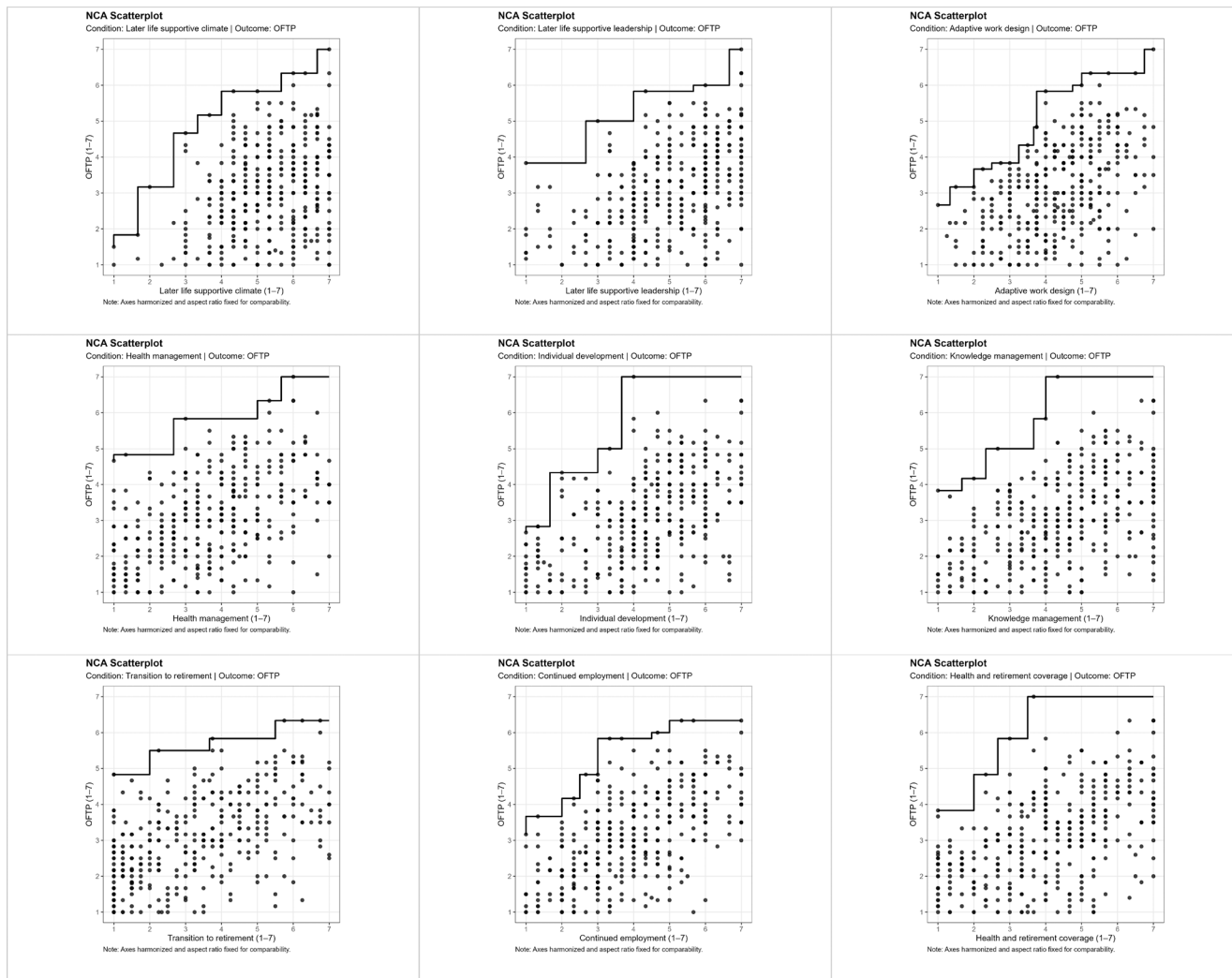
Bottleneck Table – The Netherlands

|      | Later life supportive<br>climate | Later life supportive<br>leadership | Adaptive work<br>design | Health management | Individual<br>development | Knowledge<br>management | Transition to<br>retirement | Continued<br>employment | Health and retirement<br>coverage |
|------|----------------------------------|-------------------------------------|-------------------------|-------------------|---------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|
| OFTP |                                  |                                     |                         |                   |                           |                         |                             |                         |                                   |
| 1    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| 2    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| 3    | 2.00                             | NN                                  | NN                      | 1.33              | NN                        | NN                      | NN                          | NN                      | NN                                |
| 4    | 2.33                             | NN                                  | 2.33                    | 1.33              | 2.67                      | 2.67                    | 1.33                        | 2.00                    | NN                                |
| 5    | 4.00                             | 4.00                                | 3.25                    | 3.67              | 2.67                      | 3.33                    | 2.33                        | 2.33                    | 2.00                              |
| 6    | 5.67                             | 5.67                                | 5.00                    | 4.67              | 5.00                      | 5.33                    | 5.25                        | 5.67                    | 4.67                              |
| 7    | NA                               | NA                                  | NA                      | NA                | NA                        | NA                      | NA                          | NA                      | NA                                |

Note. The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

FIGURE A6 | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

## Country: Germany



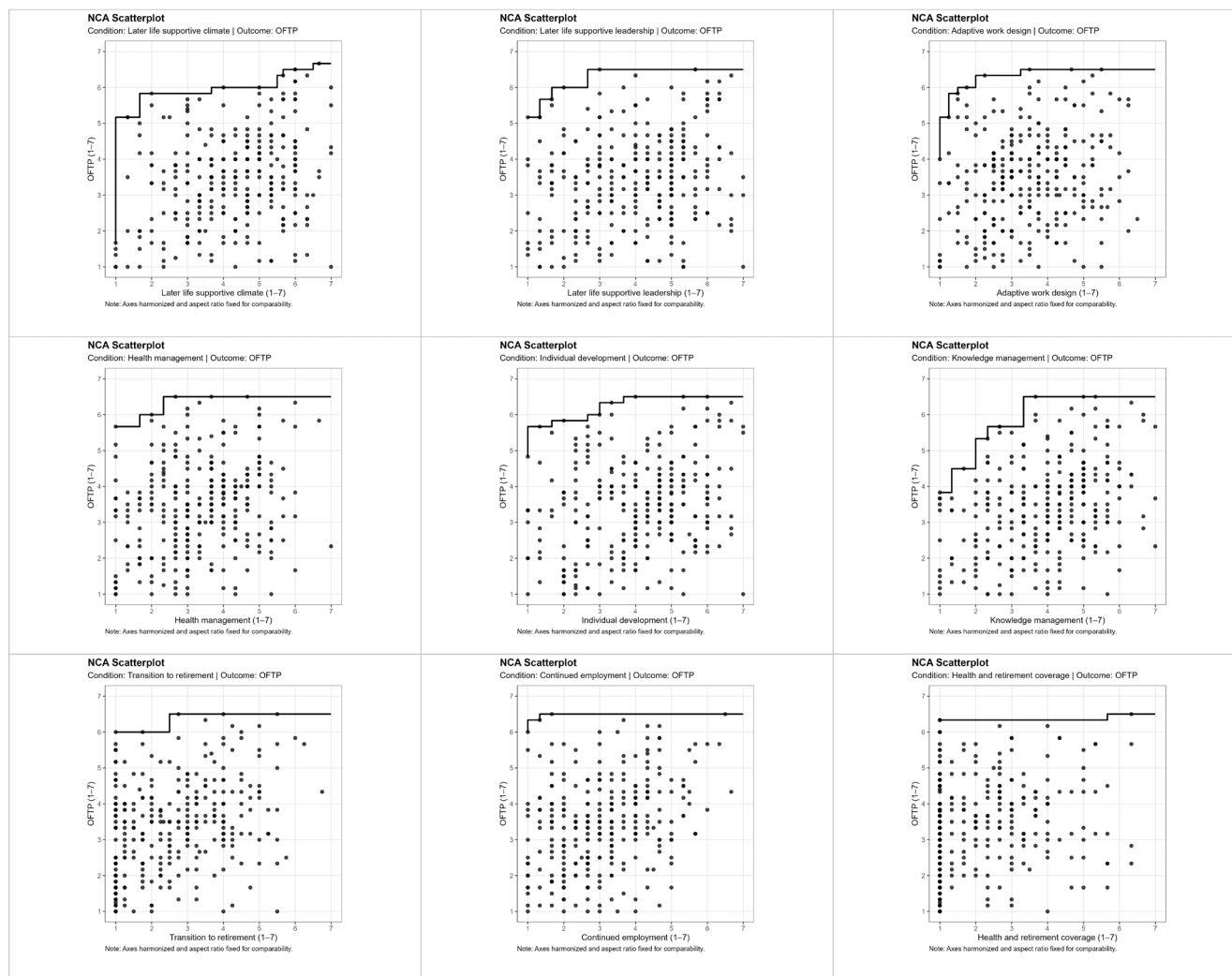
## Bottleneck Table – Germany

|             | Later life supportive<br>climate | Later life supportive<br>leadership | Adaptive work<br>design | Health management | Individual<br>development | Knowledge<br>management | Transition to<br>retirement | Continued<br>employment | Health and retirement<br>coverage |
|-------------|----------------------------------|-------------------------------------|-------------------------|-------------------|---------------------------|-------------------------|-----------------------------|-------------------------|-----------------------------------|
| <b>OFTP</b> |                                  |                                     |                         |                   |                           |                         |                             |                         |                                   |
| <b>1</b>    | NN                               | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>2</b>    | 2.00                             | NN                                  | NN                      | NN                | NN                        | NN                      | NN                          | NN                      | NN                                |
| <b>3</b>    | 2.00                             | NN                                  | 1.50                    | NN                | 2.00                      | NN                      | NN                          | NN                      | NN                                |
| <b>4</b>    | 3.00                             | 3.00                                | 3.50                    | NN                | 2.00                      | 2.00                    | NN                          | 2.33                    | 2.33                              |
| <b>5</b>    | 3.67                             | 3.00                                | 4.00                    | 3.00              | 3.33                      | 2.67                    | 2.25                        | 3.33                    | 3.00                              |
| <b>6</b>    | 6.00                             | 6.00                                | 5.00                    | 5.33              | 4.00                      | 4.33                    | 5.75                        | 4.67                    | 3.67                              |
| <b>7</b>    | 7.00                             | 7.00                                | 7.00                    | 6.00              | 4.00                      | 4.33                    | NA                          | NA                      | 3.67                              |

*Note.* The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

**FIGURE A7** | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

Country: Portugal



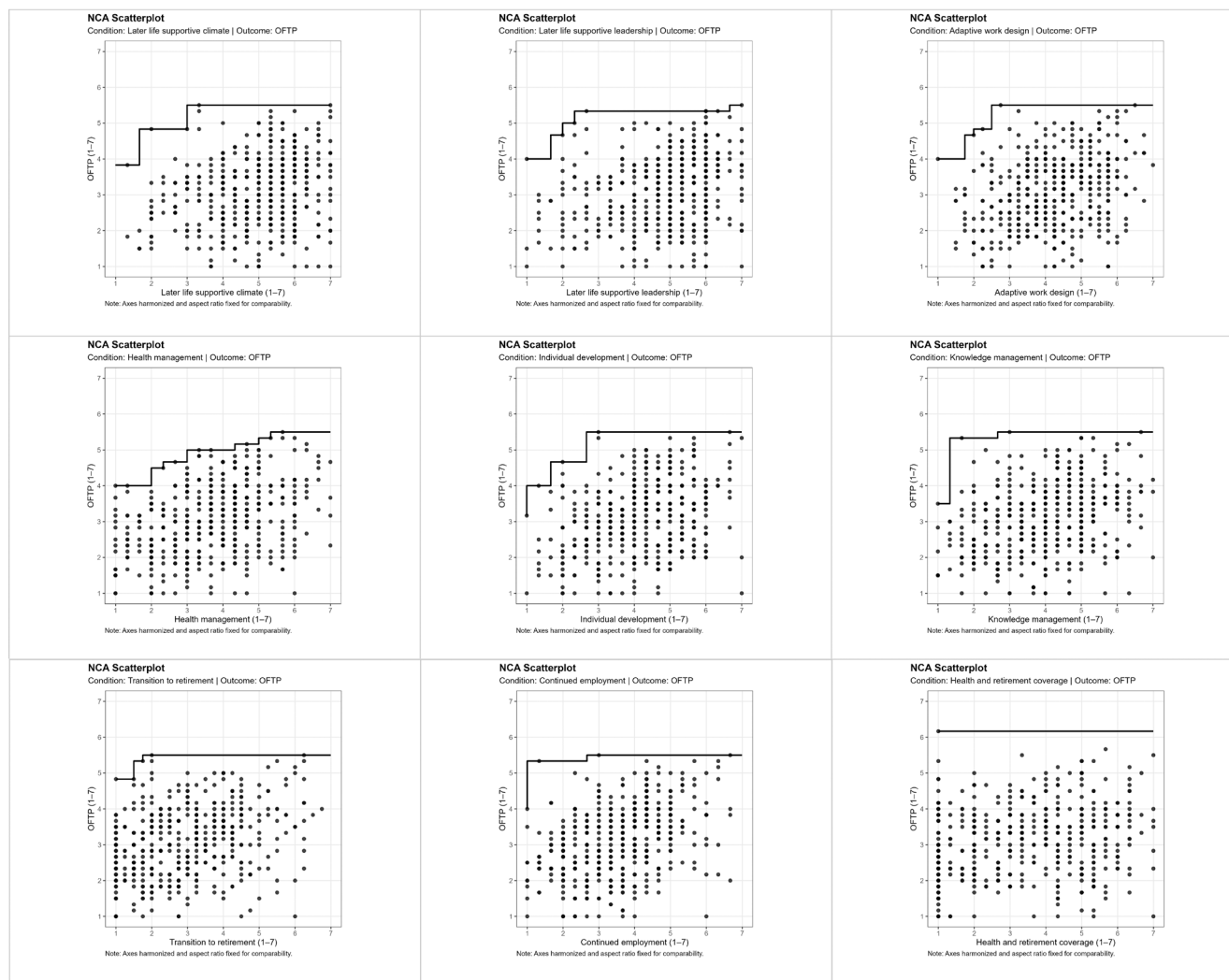
Bottleneck Table – Portugal

|      | Later life supportive climate | Later life supportive leadership | Adaptive work design | Health management | Individual development | Knowledge management | Transition to retirement | Continued employment | Health and retirement coverage |
|------|-------------------------------|----------------------------------|----------------------|-------------------|------------------------|----------------------|--------------------------|----------------------|--------------------------------|
| OFTP |                               |                                  |                      |                   |                        |                      |                          |                      |                                |
| 1    | NN                            | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 2    | 1.33                          | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 3    | 1.33                          | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| 4    | 1.33                          | NN                               | NN                   | NN                | NN                     | 1.67                 | NN                       | NN                   | NN                             |
| 5    | 1.33                          | NN                               | 1.25 <sup>a</sup>    | NN                | 1.33                   | 2.33                 | NN                       | NN                   | NN                             |
| 6    | 4.00                          | 2.00 <sup>a</sup>                | 1.75 <sup>a</sup>    | 2.00 <sup>a</sup> | 3.00                   | 3.67                 | NN                       | NN                   | NN                             |
| 7    | NA                            | NA                               | NA                   | NA                | NA                     | NA                   | NA                       | NA                   | NA                             |

Note. <sup>a</sup> Non-significant effect. The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

FIGURE A8 | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

## Country: Belgium



## Bottleneck Table – Belgium

|             | Later life supportive climate | Later life supportive leadership | Adaptive work design | Health management | Individual development | Knowledge management | Transition to retirement | Continued employment | Health and retirement coverage |
|-------------|-------------------------------|----------------------------------|----------------------|-------------------|------------------------|----------------------|--------------------------|----------------------|--------------------------------|
| <b>OFTP</b> |                               |                                  |                      |                   |                        |                      |                          |                      |                                |
| <b>1</b>    | NN                            | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| <b>2</b>    | NN                            | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| <b>3</b>    | NN                            | NN                               | NN                   | NN                | NN                     | NN                   | NN                       | NN                   | NN                             |
| <b>4</b>    | 2.00 <sup>a</sup>             | NN                               | NN                   | NN                | 1.33                   | 1.67 <sup>a</sup>    | NN                       | NN                   | NN                             |
| <b>5</b>    | 3.33 <sup>a</sup>             | 2.33 <sup>a</sup>                | 2.75 <sup>a</sup>    | 3.33              | 3.00                   | 1.67 <sup>a</sup>    | 1.75 <sup>a</sup>        | 1.33 <sup>a</sup>    | NN                             |
| <b>6</b>    | NA                            | NA                               | NA                   | NA                | NA                     | NA                   | NA                       | NA                   | NN                             |
| <b>7</b>    | NA                            | NA                               | NA                   | NA                | NA                     | NA                   | NA                       | NA                   | NN                             |

Note. <sup>a</sup> Non-significant effect. The first column refers to the OFTP levels. Abbreviations: NN = not necessary, NA = non-applicable.

**FIGURE A9** | Scatter plots and ceiling lines—ceiling envelopment with free disposal hull (CE-FDH).

## Appendix B

### Later Life Workplace Index—Short Form (LLWI-SF): English (U.S) Items (Finsel et al. 2025)

| Domain                           | English (U.S.) items                                                                                                                                                                                                   |
|----------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Later life supportive climate    |                                                                                                                                                                                                                        |
| OC-1                             | In our organization, regardless of age, all employees have the same opportunities.                                                                                                                                     |
| OC-2                             | In our organization, there is a positive attitude towards older employees.                                                                                                                                             |
| OC-3                             | In our organization, “aging” is talked about openly.                                                                                                                                                                   |
| Later life supportive leadership |                                                                                                                                                                                                                        |
| LE-1                             | Managers of our organization show appreciation both for current work results as well as for the overall performance of their employees.                                                                                |
| LE-2                             | Managers of our organization sincerely support their employees in their professional and personal development.                                                                                                         |
| LE-3                             | Managers of our organization are interested in the well-being of their employees.                                                                                                                                      |
| Adaptive work design             |                                                                                                                                                                                                                        |
| WD-1                             | Employees of our organization have enough flexibility in their working time organization to appropriately address their personal needs.                                                                                |
| WD-2                             | Employees of our organization can choose their place of work to ensure a good balance between their work and private life (work-life balance).                                                                         |
| WD-3                             | In our organization, managers change the tasks of their employees in the foreseeable future (e.g., within half a year) if the tasks no longer correspond to the employee's ability to perform and to withstand stress. |
| WD-4                             | In our organization, workplaces are designed according to ergonomic recommendations.                                                                                                                                   |
| Health management                |                                                                                                                                                                                                                        |
| HM-1                             | Employees of our organization are encouraged to move as much as possible in the workplace (e.g., use the stairs, take a walk during lunch break, exercise during lunch break, use the bicycle to work).                |
| HM-2                             | In our organization, employees receive therapeutic help in the workplace or in the immediate vicinity if required (e.g., physiotherapy in case of great physical stress and strain, stress management trainings).      |
| HM-3                             | In our organization, employees are made aware of health-promoting behavior (e.g., through training, counseling, displays).                                                                                             |
| Individual development           |                                                                                                                                                                                                                        |
| ID-1                             | In our organization, individual development prospects and qualification requirements are identified with employees, regardless of age.                                                                                 |
| ID-2                             | In our organization, older employees are offered training to learn new competencies and develop their expertise.                                                                                                       |

| Domain                         | English (U.S.) items                                                                                                                                                                          |
|--------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| ID-3                           | In our organization, employees move to a different job or position if it better suits their specific skills and abilities.                                                                    |
| Knowledge management           |                                                                                                                                                                                               |
| KM-1                           | In our organization, there are processes/procedures to systematically pass on the knowledge and experience of older employees to their younger colleagues before they leave the organization. |
| KM-2                           | In our organization, there are regular opportunities for every employee to exchange experiences and knowledge (e.g., in regular meetings).                                                    |
| KM-3                           | In our organization, older and younger employees are encouraged to share their knowledge and experience.                                                                                      |
| Transition to retirement       |                                                                                                                                                                                               |
| TR-1                           | In our organization, managers discuss early with their employees (e.g., from the age of 55) as to how to make the transition to retirement.                                                   |
| TR-2                           | In our organization, the transition to retirement is flexibly shaped according to employee needs.                                                                                             |
| TR-3                           | Our organization offers counseling to employees who are about to retire so they can reflect upon their expectations and plans for retirement.                                                 |
| TR-4                           | Our organization maintains active contact with retired employees (e.g., by an alumni network).                                                                                                |
| Continued employment           |                                                                                                                                                                                               |
| CE-1                           | In our organization, employment opportunities for people in retirement age are clearly defined and structured (e.g., by integration into strategic workforce planning).                       |
| CE-2                           | In our organization, working conditions (time and type of activity) for employees in retirement age are flexibly adapted to their wishes.                                                     |
| CE-3                           | In our organization, older applicants are hired as well.                                                                                                                                      |
| Health and retirement coverage |                                                                                                                                                                                               |
| RC-1                           | Our organization offers employees comprehensive opportunities to save money for their retirement (e.g., retirement plans offered by employer).                                                |
| RC-2                           | Our organization offers employees good personal advice on financial security in later life.                                                                                                   |
| RC-3                           | Our organization offers employees private supplemental insurance as part of the total remuneration package (e.g., additions to health or long-term care insurance, occupational disability).  |

*Note:* For the sake of construct clarity, three original LLWI dimensions were renamed: organizational climate was renamed into later life supportive climate; leadership was renamed as later life supportive leadership, and work design was renamed into adaptive work design.