

HUMAN SUSTAINABILITY: A MULTIDIMENSIONAL FRAMEWORK FOR SUSTAINING HUMAN CAPACITY ACROSS THE LIFE COURSE — TOWARD THE DEVELOPMENT OF THE HUMAN SUSTAINABILITY INDEX (HSI-CV1)

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ABSTRACT

Sustainability has traditionally been conceptualised at the level of ecological systems, natural resources, institutions, and economic development. Although contemporary frameworks increasingly recognise human well-being, the human being is often positioned as either the beneficiary of sustainable development or a resource through which sustainability is achieved, rather than as a system whose own capacity must be actively sustained. Psychological science, public health, occupational health, gerontology, and organizational research have generated extensive evidence concerning well-being, burnout, resilience, social connection, preventive behaviour, help-seeking, organizational support, and healthy ageing, but these literatures remain fragmented across disciplinary boundaries.

This paper develops a broader conceptual framework of Human Sustainability, defined as the capacity of individuals and the systems in which they live to maintain, restore, develop, and express physical, psychological, relational, social, and functional capacity over time without requiring the progressive depletion of the human resources necessary for continued participation and flourishing. The framework is developed through an integrative synthesis of literature on healthy ageing, intrinsic capacity, psychological well-being, resilience, burnout, job demands and resources, social connection, social determinants of health, preventive health behaviour, help-seeking, flourishing, autonomic regulation, restorative environments, and existing human-sustainability scholarship.

The paper proposes that Human Sustainability is neither synonymous with mental health nor reducible to individual well-being. Instead, it represents a systems-level capacity construct situated at the intersection of person, body, organization, community, natural environment, and societal structure. Six initial domains are proposed for the candidate Human Sustainability Index (HSI-CV1): (1) Psychological Well-Being and Resilience, (2) Burnout and Emotional Exhaustion, (3) Organizational and Leadership Support, (4) Community and Social Connectedness, (5) Access to Preventive Resources and Help-Seeking, and (6) Physiological Regulation and Restorative Environment. The sixth domain captures the regulatory state of the body, described heuristically as the continuum between the chronically sympathetic Red Mind and the parasympathetically anchored Blue Mind, together with access to the natural, aquatic, and temporal conditions that restore it. The model is explicitly multidirectional: sustainability requires not merely the absence of depletion but the availability of resources that enable maintenance, recovery, development, participation, and contribution.

The paper further differentiates Human Sustainability from related constructs including sustainable development, healthy ageing, intrinsic capacity, flourishing, psychological healthspan, resilience, burnout, employee sustainability, and quality of life, proposes a preliminary conceptual architecture and candidate HSI measurement model, and concludes with propositions for empirical validation, cross-cultural adaptation, longitudinal testing, and application across education, healthcare, organizations, communities, and public policy. Human Sustainability is positioned as a bridge concept linking individual psychological functioning with the social, physiological, and environmental conditions required for human capacity to remain viable across the life course.

Keywords: human sustainability, human capacity, psychological well-being, resilience, burnout, social connectedness, preventive health, help-seeking, flourishing, healthy ageing, autonomic regulation, nature connectedness, Blue Mind, Human Sustainability Index

1. Introduction

The contemporary sustainability movement has historically been concerned with a fundamental question: how can present systems meet current needs without undermining the ability of future generations to meet their own needs? The ecological and economic dimensions of sustainability have consequently received substantial scientific, political, and institutional attention.

Human beings, however, occupy an unusual position within this framework. Humans are simultaneously the designers of sustainable systems, the beneficiaries of those systems, and biological and psychological systems whose own capacity can be depleted by the environments in which they live. A society may become economically productive while exhausting its workers. An organization may increase output while increasing burnout. A healthcare system may extend survival while failing to preserve psychological or social functioning. An education system may raise achievement while undermining student well-being. A city may prosper while increasing loneliness, social fragmentation, and unequal access to preventive resources, and while severing its residents from the green and blue spaces that regulate the human nervous system.

Sustainability therefore cannot be adequately understood if the sustainability of the human system itself is omitted. The question becomes: what does it mean for a human life, organization, community, or society to remain sustainable? This question is increasingly relevant as populations live longer, work becomes more cognitively and emotionally demanding, social structures change, chronic disease becomes more prevalent, and psychological distress becomes a major component of global health burden.

The World Health Organization's healthy-ageing framework has already moved in this direction by defining healthy ageing not as absence of disease but as the process of developing and maintaining the functional ability that enables well-being in older age, arising from the interaction between intrinsic capacity and environment (World Health Organization, 2024a). Intrinsic capacity includes mental as well as physical capacities and explicitly recognises environmental supports and barriers (World Health Organization, 2021a; Yates et al., 2023).

Yet healthy ageing primarily addresses functional ability in later life. Human Sustainability is proposed as a broader life-course framework that asks whether the conditions surrounding a person continuously support the preservation, restoration, development, and expression of human capacity. This distinction connects the present paper with the first two manuscripts in this research programme. The Other Clock proposed Psychological Healthspan as a way of understanding the temporal sustainability of psychological capacity, coupled to the body through autonomic regulation. Regenerating the Human Being proposed Psychological Renewal as the process through which psychological capacities may be restored, reorganised, or developed following disruption, and identified autonomic stabilisation as its precondition.

The present paper takes the next step. If psychological capacity can be preserved and renewed, what conditions allow that capacity to remain sustainable? The answer cannot reside entirely within the individual. Human capacity is shaped by social relationships, economic resources, organizational environments, access to healthcare, leadership, education, physical and natural environments, cultural systems, and opportunities for meaningful participation. The resulting framework therefore moves from an individual psychology of capacity toward a systems psychology of sustainability.

2. Conceptual Background

2.1 From Environmental Sustainability to Human Sustainability

Sustainability is frequently discussed through environmental and economic metrics. However, the WHO explicitly links sustainable development with health and well-being and argues that sustainable development policies have implications for present and future health (World Health Organization, 2024c). The WHO's work on well-being similarly frames well-being as relevant across the Sustainable Development Goals and links individual and collective well-being with health, economic, social, environmental, and equity considerations (World Health Organization, 2021b). This establishes an important conceptual premise: sustainability is not external to human well-being. It is partly constituted by it.

However, a second conceptual step is necessary. If sustainability depends upon human beings being capable of learning, working, caring, relating, adapting, and participating, then the sustainability of those capacities becomes an object of scientific interest in its own right. Human Sustainability therefore asks a different question from conventional sustainable development: are the systems in which people live reproducing the conditions necessary for people to remain capable?

There is, moreover, a literal hinge between the two discourses. The natural environments that environmental sustainability seeks to protect are among the most effective regulators of the human nervous system: roughly 120 minutes of weekly nature contact is associated with good health and well-being (White et al., 2019), and greenspace exposure is associated with lower cortisol, heart rate, and blood pressure across more than a hundred studies (Twohig-Bennett & Jones, 2018). Sustaining the human being and sustaining the environment are, at this point of contact, the same project.

3. Existing Human Sustainability Scholarship

The term Human Sustainability should be situated carefully within existing scholarship. Barnes et al. (2023) conducted a meta-synthesis of 368 meta-analyses and review articles and developed Restricted Employee Sustainability Theory (REST), which uses maintenance, growth, and generativity to describe how people sustain physical, psychological, and social health in the workplace. This work demonstrates that human sustainability can be understood as more than employee health and that maintenance, growth, and generativity can be treated as theoretically connected processes.

However, REST is intentionally restricted to employment and organizational contexts. Subsequent work in this tradition has examined leadership and organizational responsibility for human sustainability, arguing that it cannot simply be placed on individual employees and emphasising organizational culture and leadership as determinants of sustainable functioning (Barnes et al., 2023; Pfeffer, 2018).

The present framework does not claim that human sustainability has been absent from scholarship. It proposes a broader synthesis: Human Sustainability should be studied across the life course and across levels of human ecology rather than

exclusively within employment, incorporating the individual, physiological, relational, organizational, community, environmental, and structural levels.

4. Review Method

4.1 Review Design

This manuscript adopts a PRISMA 2020-informed integrative review approach. Because Human Sustainability is an emerging interdisciplinary construct rather than an established intervention with a single homogeneous outcome, a conventional meta-analysis would be inappropriate. The objective is to synthesise evidence from multiple literatures that collectively address the preservation and depletion of human capacity: systematic reviews, meta-analyses, longitudinal studies, psychometric, occupational-health, public-health, gerontological, organizational, psychophysiological, and environmental-psychology research, and the social-determinants literature.

4.2 Review Question

The primary question is: what individual, physiological, relational, organizational, community, environmental, and structural conditions enable human psychological and functional capacity to remain sustainable across time?

Secondary questions include which conditions protect psychological capacity and which contribute to depletion; what role social relationships, organizational environments, and access to preventive resources play; how the regulatory state of the body, and access to environments that restore it, condition all of the above; how sustainability can be distinguished from well-being or absence of illness; and whether these dimensions can be integrated into a measurable Human Sustainability Index.

5. Conceptual Definition of Human Sustainability

This paper proposes the following definition: Human Sustainability is the capacity of individuals and the systems in which they live to maintain, restore, develop, and express physical, psychological, relational, social, and functional capacities across time without requiring unsustainable depletion of the resources necessary for continued health, participation, adaptation, and contribution.

This definition contains six essential elements. Capacity: Human Sustainability concerns what people are able to do and become, rather than merely what symptoms they do or do not experience. Continuity: sustainability requires capacity to remain viable across time. Restoration: human systems must possess mechanisms for recovery following disruption. Development: sustainability includes growth and acquisition of new capacities. Context: human capacity depends partly on environmental conditions. Non-depletion: a system cannot be considered genuinely sustainable if maintaining current performance systematically consumes the human resources required for future functioning.

6. Human Sustainability as a Multilevel Construct

Human Sustainability is proposed as a nested systems construct.

Level 1 — Individual: psychological and physical capacities, including the autonomic regulatory state of the body. Level 2 — Relational: family, friendship, attachment, social connection, and community relationships. Level 3 — Organizational: leadership, workload, autonomy, psychological safety, recognition, resources, and culture. Level 4 — Community: social infrastructure, participation, belonging, safety, education, healthcare, and collective resources, including green and blue space. Level 5 — Structural: economic opportunity, inequality, policy, healthcare access, social protection, and environmental conditions.

This multilevel structure is consistent with the WHO social-determinants framework, which defines social determinants as the conditions in which people are born, grow, live, work, and age and emphasises their major role in health inequities (World Health Organization, 2023). Human Sustainability therefore cannot be reduced to individual resilience. A person may be highly resilient while living in an unsustainable environment. The framework must therefore distinguish individual capacity from environmental capacity to sustain the individual.

7. Evidence Domain I: Psychological Well-Being and Resilience

Psychological well-being is a central component of sustainable human functioning. Ryff's multidimensional model conceptualises it through autonomy, environmental mastery, personal growth, positive relations, purpose in life, and self-acceptance (Ryff, 1989). These dimensions are relevant because sustainability requires more than positive mood: a sustainable human system should permit people to regulate themselves, maintain relationships, develop, experience purpose, exercise agency, and adapt to environmental demands.

Resilience contributes another dimension. Individuals differ substantially in their responses to adversity; some experience prolonged dysfunction, whereas others maintain stable functioning or recover over time. Sustainability therefore requires not only protection from stress but adaptive capacity in response to it. However, resilience must not become an excuse for placing responsibility on individuals. A system that continuously exposes individuals to excessive demands cannot be considered sustainable merely because some individuals tolerate those demands.

8. Evidence Domain II: Burnout and Emotional Exhaustion

Burnout is one of the clearest examples of human capacity becoming unsustainable. ICD-11 classifies it as an occupational phenomenon resulting from chronic workplace stress that has not been successfully managed, characterised by exhaustion, cynicism toward work, and reduced professional efficacy (World Health Organization, 2024b). Burnout is not simply "being tired." It reflects a sustained mismatch between human capacity and environmental demands.

The job demands-resources literature provides substantial empirical support for this systems interpretation. Meta-analytic evidence indicates that higher job demands are associated with burnout, whereas resources are negatively associated with burnout and positively associated with engagement (Crawford et al., 2010). Similarly, Alarcon's (2011) meta-analysis found that higher demands, lower resources, and less adaptive organizational attitudes were associated with burnout. Burnout therefore represents more than an individual psychological state. It is an indicator of unsustainable demand-resource conditions. It is also, in physiological terms, the occupational face of the Red Mind: chronic sympathetic mobilisation without adequate recovery. This leads to a fundamental proposition: a sustainable organization is not one in which employees are trained to tolerate unlimited demands; it is one in which demands and resources remain sufficiently balanced to permit continued human functioning.

9. Evidence Domain III: Organizational and Leadership Support

Human beings spend substantial portions of their lives within organizations. Consequently, organizational structures become part of the ecology of human sustainability. Leadership influences workload, autonomy, recognition, psychological safety, access to resources, role clarity, interpersonal trust, and opportunities for development.

The organizational human-sustainability literature increasingly recognises that responsibility cannot be located exclusively within individual employees. Human sustainability requires organizational structures that actively support sustainable functioning (Barnes et al., 2023). This is consistent with the job-demands-resources model, which demonstrates reciprocal relationships between job characteristics and employee well-being (Bakker & Demerouti, 2017). The implication is that organizational support should be considered an antecedent of human sustainability, rather than merely an outcome.

10. Evidence Domain IV: Community and Social Connectedness

Human sustainability is fundamentally relational. The U.S. Surgeon General's advisory identifies social connection as an important contributor to individual and population health, resilience, community safety, and prosperity (U.S. Department of Health and Human Services, 2023). Social sustainability cannot be measured simply by counting how many people an individual knows; the relevant constructs include belonging, meaningful relationships, relational quality, social support, community participation, loneliness, isolation, and reciprocal contribution. A person may have extensive digital contact while profoundly lonely, or a small network with strong meaningful relationships. Human Sustainability should therefore focus on functional social connectedness, not network size. Notably, the social and environmental domains intersect: most studies find that access to green space is associated with lower loneliness, plausibly because shared natural settings are where community contact happens (Astell-Burt et al., 2022).

11. Evidence Domain V: Preventive Resources and Help-Seeking

A sustainable human system must have access to mechanisms that prevent small problems from becoming large ones: primary healthcare, mental-health services, screening, health education, psychological support, rehabilitation, social services, financial and occupational support, and community resources. Help-seeking is particularly important. A person may recognise distress but lack the psychological, social, financial, or institutional resources necessary to obtain assistance. Need without access is not sustainable care. The WHO's social-determinants framework emphasises that access to resources and social position substantially shape health outcomes and inequities (World Health Organization, 2023). The HSI therefore treats access to preventive resources not simply as a healthcare variable but as a structural component of human sustainability.

12. Evidence Domain VI: Physiological Regulation and Restorative Environment

The five domains above describe the mind and its social ecology. None describes the body in which that mind is sustained, yet every capacity in Domains I to V depends on a nervous system that can recover. The neurovisceral integration model holds that the prefrontal-vagal circuit supporting emotion regulation, flexible attention, and social engagement can be read peripherally as heart rate variability (HRV) (Thayer & Lane, 2000; Thayer et al., 2012); polyvagal theory places the same vagal system at the root of the capacity for safety and connection (Porges, 2007); and HRV declines with age (Umetani et al., 1998) and predicts all-cause mortality (Jarczok et al., 2022). Nichols (2014) named the two poles of this regulatory continuum: the Red Mind, the overstimulated, chronically stressed state of modern life, and the Blue Mind, the mildly meditative, restorative state that people reliably enter near, in, or on water. Physiologically, the Red Mind is sympathetic dominance without recovery, marked by suppressed HRV, elevated resting heart rate, and fragmented sleep; the Blue Mind is parasympathetically anchored alert calm, marked by rising HRV, slowed breathing, and a predominance of the electroencephalographic alpha rhythm (Klimesch, 2012; Lomas et al., 2015).

The sixth domain has two components. The first is regulatory capacity: the ease with which a person recovers after demand, indexed by sleep quality, subjective vitality (Ryan & Frederick, 1997), recovery experiences after work (Sonnentag & Fritz, 2007), and, where available, resting heart rate and HRV. The second is access to restorative conditions, which are largely environmental and therefore belong in a sustainability framework on the same footing as leadership or healthcare access: contact with natural environments (White et al., 2019; Robat et al., 2026); proximity to and immersion in blue space (Georgiou et al., 2021; White et al., 2020); slow-breathing practice, which reliably raises HRV (Laborde et al., 2022); and protection of the two transitional hours of the day, the first after waking, when the cortisol awakening response occurs (Stalder et al., 2016), and the last before sleep, when circadian timing is set and readily disrupted by screen light (Chang et al., 2015). Nature connectedness is measurable in six items (Nisbet & Zelenski, 2013) and is associated with eudaimonic well-being (Pritchard et al., 2020); perceived restorativeness of one's environment has an established scale (Hartig et al., 1997). Grounding, direct skin contact with the earth, has been reported to improve sleep and autonomic tone in small studies and is included only as an exploratory indicator pending replication (Chevalier et al., 2012).

Two features justify placing this domain in an index of sustainability. It is the domain through which environmental and human sustainability become one measurement, since the green and blue space a city protects is the regulatory resource its residents draw on; and it is the least expensive and most universally accessible lever in the framework, which makes it the domain in which inequity is least defensible and intervention most feasible.

13. Human Sustainability and Flourishing

Flourishing is another important comparator. The Global Flourishing Study uses a multidimensional conception of flourishing and follows more than 200,000 participants across 22 countries with annual data collection over five years (VanderWeele et al., 2025). Flourishing asks how well a person is doing; Human Sustainability asks what conditions allow a person to continue doing well, recover when disrupted, and remain capable over time. Flourishing = state/outcome; Human Sustainability = capacity + conditions + continuity. Flourishing may be an outcome of Human Sustainability without being synonymous with it.

14. Human Sustainability and Healthy Ageing

WHO's healthy-ageing model concerns maintaining the functional ability that enables well-being in older age, arising from intrinsic capacity in interaction with environment (World Health Organization, 2024a). Human Sustainability extends this logic in two directions: it is life-course rather than age-oriented, and it explicitly incorporates organizational, community, and natural-environmental systems as determinants of sustainable capacity. It therefore includes healthy ageing but is not restricted to it.

15. Human Sustainability and Psychological Healthspan

The relationship to Paper 1 is central. Psychological Healthspan describes the temporal dimension of psychological capacity; Human Sustainability describes the system of conditions that supports it. Conceptually: Human Sustainability → conditions; Psychological Healthspan → duration; Psychological Renewal → adaptation/change; autonomic regulation (Red Mind ↔ Blue Mind) → the physiological interface shared by all three; functional outcomes → expression.

16. The Human Sustainability Cycle

The proposed model is not static. Human Sustainability can be conceptualised as a continuous cycle: resources → capacity → function → participation → contribution → recovery/renewal → further capacity. The cycle becomes unsustainable when demands consistently exceed resources, producing depletion → exhaustion → disengagement → functional decline → reduced participation → further depletion. Conversely, sustainable environments generate resources → capacity → engagement → contribution → meaning → replenishment → continued capacity. The recovery/renewal step is where the body re-enters the loop: it is autonomic as much as psychological, and it can be shortened or lengthened by the restorative conditions described in Domain VI.

17. Proposed Human Sustainability Domains

The initial candidate HSI-CV1 consists of six domains.

Domain 1: Psychological Well-Being and Resilience captures positive psychological functioning and adaptive capacity: emotional stability, perceived well-being, coping confidence, resilience, adaptability, recovery after stress, and psychological agency.

Domain 2: Burnout and Emotional Exhaustion captures depletion of psychological and emotional resources: exhaustion, cognitive weariness, cynicism, reduced efficacy, inability to recover, and persistent work-related stress. This domain should be scored directionally so that greater depletion corresponds to lower Human Sustainability.

Domain 3: Organizational and Leadership Support captures the degree to which environments support sustainable functioning: workload manageability, autonomy, leadership support, psychological safety, recognition, role clarity, fairness, development opportunities, and organizational responsiveness.

Domain 4: Community and Social Connectedness captures relational and community capacity: meaningful relationships, social support, belonging, loneliness, social participation, community trust, and reciprocal contribution.

Domain 5: Access to Preventive Resources and Help-Seeking captures whether people can access mechanisms that prevent deterioration and support recovery: healthcare and mental-health access, preventive screening, awareness of services, help-seeking confidence, affordability, geographic accessibility, cultural acceptability, and perceived safety of seeking help.

Domain 6: Physiological Regulation and Restorative Environment captures the regulatory state of the body and access to the conditions that restore it: perceived recovery capacity, sleep quality, subjective vitality, frequency of nature contact, access to green and blue space, regular breathing or contemplative practice, protection of the first and last hours of the day, nature connectedness, and, where feasible, resting heart rate and HRV from consumer wearables.

18. Why Six Domains?

The six domains collectively capture four sides of sustainability: internal capacity (well-being, resilience, emotional functioning); depletion (burnout, exhaustion); environmental support (organizational conditions, social connectedness, restorative natural environment); and preventive and regulatory infrastructure (access to resources and help-seeking, and the physiological capacity to recover). The framework therefore avoids reducing Human Sustainability to a psychological trait. People cannot sustainably function without supportive environments, and the body is the first environment the mind lives in.

19. Candidate HSI Architecture

A preliminary model is: HUMAN SUSTAINABILITY = Individual Capacity + Depletion (scored inversely) + Organizational Ecology + Relational Ecology + Preventive Ecology + Regulatory Ecology (autonomic regulation + restorative environment).

These domains interact rather than operate independently. Poor organizational support may increase burnout; burnout may reduce social participation; social isolation may reduce resilience; low access to care may prolong distress; and a person held in the Red Mind by workload and sleep loss will show it in every other domain. Conversely, strong social connection may support resilience, supportive leadership may reduce burnout, preventive resources may facilitate early intervention, and regular access to the Blue Mind may buffer the effect of demands on depletion. This network perspective is more theoretically appropriate than assuming six independent subscales.

20. Reflective Versus Formative Measurement

A major psychometric question concerns whether the HSI should be treated as reflective or formative. A reflective construct assumes that an underlying latent variable causes the observed indicators (psychological distress → sadness, anxiety, sleep disturbance); a formative construct assumes that multiple components combine to create the construct. For Human Sustainability, the formative model may initially be more plausible. Psychological well-being, organizational support, social connectedness, physiological regulation, and preventive access are not interchangeable manifestations of a single latent state: an individual could have high well-being, low organizational support, strong community connection, excellent healthcare access, moderate burnout, and poor sleep. Removing one domain does not mean the construct ceases to exist. The HSI should therefore initially be tested as a multidimensional composite or hierarchical formative system, while empirically comparing alternative models.

21. Preliminary Mathematical Representation

A candidate HSI score could theoretically be represented as:

$$\text{HSI} = w_1\text{PWB} + w_2\text{RES} - w_3\text{BURN} + w_4\text{ORG} + w_5\text{SOC} + w_6\text{PREV} + w_7\text{REG}$$

where PWB = psychological well-being; RES = resilience; BURN = burnout/emotional exhaustion; ORG = organizational/leadership support; SOC = social/community connectedness; PREV = preventive-resource access; and REG = physiological regulation and restorative-environment access. This equation is conceptual rather than a validated scoring algorithm. The weights must be derived empirically through factor analysis, item-response modelling, structural equation modelling, predictive validity, expert consensus, longitudinal data, and sensitivity analysis.

22. Human Sustainability as a Dynamic State

The HSI should not be conceptualised as a permanent personality characteristic. A more useful interpretation is that Human Sustainability represents the current and prospective capacity of a person to maintain functioning under ordinary demands, recover from disruption, access necessary resources, remain socially connected, and continue developing over time. A person's Human Sustainability may therefore decline during chronic stress, unemployment, caregiving, illness, bereavement, or organizational instability, and may increase following treatment, social reconnection, improved working conditions, preventive care, skill development, community support, or restoration of regulatory rhythm through sleep, nature, and breath. This dynamic property is central to the concept.

23. Propositions

Proposition 1. Human Sustainability is multidimensional rather than reducible to psychological well-being alone.

Proposition 2. Human Sustainability is partly determined by environmental conditions outside the individual.

Proposition 3. Chronic imbalance between demands and resources is associated with depletion of human sustainability.

Proposition 4. Social connectedness functions as a protective resource for sustainable human functioning.

Proposition 5. Access to preventive resources increases the probability of early intervention and capacity preservation.

Proposition 6. Organizational and leadership support influence Human Sustainability partly through their effects on burnout, engagement, and psychological resources.

Proposition 7. Human Sustainability is dynamic and can change over time.

Proposition 8. Human Sustainability predicts functional participation beyond conventional measures of mental-health symptoms.

Proposition 9. Human Sustainability is culturally patterned but contains potentially universal functional dimensions.

Proposition 10. Human Sustainability is empirically distinguishable from psychological well-being, flourishing, resilience, burnout, and healthy ageing.

Proposition 11. Physiological regulation partially mediates the effect of environmental conditions on psychological capacity, and access to restorative environments moderates the relationship between demands and depletion.

24. Qualitative Dimension of Human Sustainability

A quantitative index alone cannot fully capture the lived experience of sustainability. Future qualitative research should examine how individuals describe feeling sustainable or depleted, recovering, being supported, being unable to seek help, remaining connected, finding meaning, and participating despite adversity. Potential interview questions include: "What helps you continue functioning when life becomes difficult?" "What tends to exhaust you over long periods?" "What allows you to recover?" "Where do you go when you need to feel calm?" "What prevents you from seeking help?" These data can identify domains that may not be visible in conventional psychometric measures.

25. Cultural Architecture

Human Sustainability should not be constructed exclusively around Western individualism. In individualistic societies, autonomy and self-directed achievement may be emphasised; in collectivist settings, family responsibility, reciprocity,

community belonging, and relational obligation may be more central. Cultures also differ in how they regulate the body: contemplative and breath-based traditions of the Indian subcontinent embed Domain VI practices in daily life, and this is itself a source of measurable variation.

Therefore, cross-cultural research should test whether the same measurement structure operates equivalently across gender, age, socioeconomic groups, rural and urban populations, cultures, occupational groups, and countries. Measurement invariance should be treated as a fundamental component of HSI validation rather than an optional secondary analysis. The Global Flourishing Study provides a useful methodological precedent for examining well-being across culturally and geographically diverse populations (VanderWeele et al., 2025).

26. Equity and Human Sustainability

Sustainability cannot be separated from equity. If access to psychological support, healthcare, education, safe housing, meaningful employment, social participation, and natural and blue space is systematically unequal, Human Sustainability will also be unequally distributed (World Health Organization, 2023). A low HSI score should therefore never automatically be interpreted as an individual deficit; it may represent an environmental deficit. The purpose of the HSI is to identify where human capacity is being unsupported, not to blame individuals for failing to remain resilient.

27. Applications

In healthcare, HSI could identify individuals at risk of psychological depletion before severe clinical deterioration, including healthcare workers themselves. In the workplace, organizations could evaluate whether productivity systems are compatible with sustainable human functioning. In education, schools and universities could assess psychological resources, belonging, burnout, support, and help-seeking. In community health and urban planning, community-level measurement could identify social disconnection, preventive-resource gaps, and deficits in access to restorative environments. In public policy, population-level HSI data could complement conventional health and economic indicators. In ageing, HSI could provide a life-course measure of the conditions supporting capacity before and during later life.

28. Human Sustainability and the Future of Work

The future of work makes the concept especially relevant. Automation, artificial intelligence, hybrid work, extended working lives, increasing cognitive demands, and blurred work-life boundaries may alter the relationship between human capacity and organizational demands. The relevant question is no longer simply whether employees can perform, but whether they can continue to perform without progressively consuming the psychological, physiological, and social resources required for future functioning. The job-demands-resources literature demonstrates why this matters (Bakker & Demerouti, 2017; Crawford et al., 2010). Human Sustainability therefore reframes productivity: sustainable productivity means performance that does not systematically destroy the capacity required to produce future performance.

29. Human Sustainability and Longevity

Longer life increases the importance of sustainability. If people live longer but experience prolonged distress, isolation, chronic exhaustion, limited preventive care, loss of purpose, or organizational depletion, additional years may not translate into additional years of sustainable functioning. Longevity asks how long we can live; healthspan, how long we can remain functionally healthy; Psychological Healthspan, how long psychological capacity can remain functional; Psychological Renewal, how it can be restored and developed; Human Sustainability, what conditions allow all of these capacities to remain viable across time.

30. Discussion

The central contribution of this paper is the proposition that human sustainability should be conceptualised as a capacity-and-context construct rather than as another synonym for well-being. The existing literature already provides strong evidence for each component: psychological well-being and resilience as internal resources; burnout as depletion; organizational and leadership support as environmental resources; social connectedness as relational infrastructure; preventive access and help-seeking as mechanisms for early detection and recovery; and physiological regulation and restorative environment as the bodily and ecological substrate on which all the others rest. The conceptual contribution lies in integrating these literatures into a common framework concerned with continuity of human capacity across time.

This framework also extends existing human-sustainability scholarship. Barnes et al.'s (2023) REST conceptualises human sustainability through maintenance, growth, and generativity in work contexts. The present framework extends the question beyond employment. People are simultaneously family members, caregivers, friends, citizens, learners, patients, workers, creators, and contributors, and they are bodies that must sleep, breathe, and recover. A framework that focuses on only one of these roles risks measuring occupational sustainability rather than human sustainability.

31. Theoretical Contribution

Four theoretical contributions are proposed. First, a bridge construct connecting psychological science with public health, organizational behaviour, gerontology, environmental psychology, and sustainability science. Second, capacity rather than symptom orientation. Third, person-in-system architecture, which rejects the assumption that human sustainability is solely an individual responsibility; resilience-based approaches can unintentionally shift responsibility for systemic dysfunction onto individuals, and a genuinely sustainable framework must ask both how resilient the person is and how supportive the system is. Fourth, embodiment: by including the regulatory state of the body and the environments that restore it, the framework makes human sustainability continuous with environmental sustainability and opens the index to objective physiological anchoring.

32. Limitations

Several limitations must be acknowledged. First, Human Sustainability is not yet a validated construct. Second, the term already has established use within organizational research, so the present framework must be positioned as an extension rather than a first introduction. Third, the six-domain HSI is theoretical and requires empirical item development; the sixth domain is new and may prove to load on existing domains, to split into regulatory and environmental components, or to require objective rather than self-report measurement. Fourth, the domains may be interdependent. Fifth, the formative-versus-reflective question requires empirical investigation. Sixth, cultural differences may alter the meaning and relative importance of domains. Seventh, a numerical index may create false precision if used without contextual interpretation. Eighth, the Red Mind and Blue Mind labels are heuristic descriptions of a continuum, not validated categories, and evidence for some Domain VI indicators, notably grounding, is preliminary. Ninth, HSI should not be used diagnostically unless and until validation establishes clinical utility.

33. Future Research Programme

The proposed empirical programme contains six stages.

Stage 1 — Construct mapping against well-being, flourishing, resilience, psychological healthspan, intrinsic capacity, healthy ageing, employee sustainability, social sustainability, nature connectedness, and quality of life. Stage 2 — Qualitative development through interviews and focus groups across age groups, occupations, socioeconomic strata, genders, urban and rural populations, and cultural contexts. Stage 3 — Item development: an initial pool of approximately 60–100 candidate items across the six domains. Stage 4 — Expert validation by multidisciplinary experts in psychology, psychiatry, public health, occupational health, sociology, gerontology, organizational behaviour, clinical medicine, psychophysiology, and psychometrics. Stage 5 — Psychometric validation: exploratory and confirmatory factor analysis, reliability, convergent validity (including against wearable HRV and validated nature-connectedness and recovery scales), discriminant and incremental validity, and measurement invariance. Stage 6 — Longitudinal predictive validation against burnout, depression, anxiety, quality of life, sickness absence, healthcare utilisation, functional capacity, social participation, work engagement, life satisfaction, flourishing, and objective physiological recovery.

34. Proposed Research Hypotheses for Paper 4

- H1. Higher baseline HSI scores will be associated with higher psychological well-being at follow-up.
- H2. Higher baseline HSI scores will predict lower subsequent burnout.
- H3. Higher HSI scores will predict greater social participation.
- H4. Higher HSI scores will predict greater help-seeking and preventive-care utilisation when clinically indicated.
- H5. Organizational support will independently predict HSI after controlling for individual psychological characteristics.
- H6. Social connectedness will moderate the relationship between psychological stress and subsequent depletion.
- H7. HSI will explain variance in functional outcomes beyond conventional measures of mental-health symptoms.
- H8. HSI will demonstrate longitudinal stability while remaining sensitive to meaningful environmental and psychological change.
- H9. The relationship between HSI and outcomes will vary across cultural and socioeconomic contexts.
- H10. Changes in HSI will predict changes in psychological healthspan.
- H11. Domain VI scores will correlate with vagally mediated HRV, and access to restorative environments will moderate the relationship between demands and depletion.

35. Conclusion

Human beings are frequently discussed within sustainability science as beneficiaries, consumers, workers, or agents of environmental change. They should also be understood as systems whose own capacity requires sustainability. Human Sustainability provides a framework for examining whether the environments in which people live allow them to maintain capacity, recover from disruption, develop, remain connected, access preventive resources, participate meaningfully, and continue contributing without unsustainable depletion.

The framework proposed here integrates six initial domains: Psychological Well-Being and Resilience; Burnout and Emotional Exhaustion; Organizational and Leadership Support; Community and Social Connectedness; Access to Preventive Resources and Help-Seeking; and Physiological Regulation and Restorative Environment. The resulting Human Sustainability Index should at this stage be regarded explicitly as a candidate framework, not a validated instrument. Its scientific value will depend on whether subsequent empirical research demonstrates that these dimensions form a coherent and useful measurement architecture and, more importantly, whether HSI provides information about future human functioning that existing measures do not adequately capture.

The deeper theoretical proposition is that sustainability should not stop at the environment around the human being. It must include the human capacity within that environment, and the body through which that capacity is lived. A society is not fully sustainable if its people must continuously sacrifice psychological health, relationships, meaning, agency, and future capacity to maintain present productivity; an organization is not sustainable if it achieves current performance through chronic depletion of the people who make future performance possible; and a longevity programme is not complete if it extends biological life without creating the social, environmental, and psychological conditions required for people to remain capable within that life.

Human Sustainability therefore represents a shift in emphasis: from sustaining systems for humans to sustaining humans within systems. The ultimate scientific task is now empirical. Can human sustainability be measured? Can it change? Can it predict future functioning? Can interventions increase it? And can societies be redesigned to protect it? These questions provide the empirical foundation for the next paper in this programme: the development, psychometric validation, and longitudinal predictive testing of the Human Sustainability Index.

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