TASK™ by Sulitest – The Assessment of Sustainability Knowledge

Position Paper

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To build a sustainable future, it is imperative that we improve sustainability knowledge, skills, and mindsets across the globe. While the world certainly needs experts able to solve specific and technical problems in their respective fields, it is now essential that all humans acquire at least a minimum of general sustainability knowledge. As such, educators everywhere must ensure that today's growing number of college graduates and emerging professionals achieve a sufficient level of knowledge and understanding of the basics of Earth sustainability as well as the ability to integrate such learning into personal and professional practice, into social interaction, and into civic action and public decision-making. The Sulitest team and wider supporting Sulitest movement provide online awareness, engagement, and assessment tools that enable the mainstreaming of sustainability literacy within both institutions of Higher Education and professional and corporate organizations across the globe. The collective task ahead of building a sustainable future is as immense as it is urgent. Join us today!

In early 2023, Sulitest released *TASK™ – The Assessment of Sustainability Knowledge* – with the ambition of **transforming education by (re)setting the standard of sustainability knowledge** which, henceforth, must constitute the very foundation of human decision-making and agency. The TASK™ tool provides a robust, research-based, and online assessment process leading to an internationally recognized certificate of sustainability knowledge. TASK™ is accessible via an easy-to-use platform that provides relevant and comparable metrics for monitoring and steering education for sustainability across any educational program.

By design, TASK™ was built to align with existing pedagogical approaches to education for sustainability, sustainable development, and ecological transition. These include UNESCO's *Education for Sustainable Development Goals: Learning Objectives* (UNESCO, 2017), the European Union's *GreenComp: European Sustainability Competence Framework* (Bianchi, Pisiotis, & Cabrera Giraldez, 2022), the French report *Sensibiliser et former aux enjeux de la transition écologique dans*

l'Enseignement supérieur (Jouzel & Abadie, 2022), and the *Four-Dimensional Education Framework* by the Center for Curriculum Redesign (Fadel, Bialik, & Trilling, 2015). Together, these frameworks provide a comprehensive foundation for defining and assessing sustainability knowledge across disciplines and institutions.

While TASK™ is but one tool in Sulitest's education for sustainability toolbox—focused as it is on core cognitive knowledge—it fills an important gap in the landscape of sustainability assessment by measuring one's level of knowledge revealed through multiple item-responses situated within a holistic, integrated, systemic, and interdisciplinary structure.

While curriculum and pedagogical transformation takes multiple forms across diverse contexts, **TASK™ is the transformational tool that makes sustainability a common language for all,** regardless of the degree, specialization, profession, or business sector. It constitutes a base of common knowledge upon which engineers, managers, biologists, and public authorities, for example, can communicate and use as a common "tongue" as they work together to build a sustainable tomorrow. Of course, knowledge is not enough; sustainability literacy also requires a discrete mix of appropriate attitudes and competency-based skills and behaviors that enable action. However, several studies (including those cited above) provide compelling evidence that the sharing of a common base of knowledge is crucial to enabling transformative action and triggering systemic change.

The development of TASK™ has proceeded through the following phases:

1. Defining the model of sustainability knowledge (i.e., the focus of this paper)
2. Assessment design and question/item development
3. Pilot testing, sampling, and data analysis for internal consistency, robustness reliability, and validity
4. Launch and continuous improvement via an iterative process of quality control.

This position paper focuses on the first foundational phase and includes two main sections: 1) defining our model of sustainability knowledge and 2) mapping such knowledge onto a matrix.

1. Defining our model of sustainability knowledge

While the ancient Greek geographer and astronomer Eratosthenes proved that the Earth was round some 2500 years ago, it was only quite recently that humanity started realizing that Earth also had boundaries—i.e., limits to what can be extracted from, emitted into, or altered within Earth's natural systems. By transgressing these boundaries, humanity is upsetting and endangering the delicate balance that makes Earth a unique place in the galaxy—the only place we know of where a community of terrestrial life, including *Homo sapiens,* can thrive and flourish.

To preserve our blue-green planetary home, **what is needed is a paradigm shift toward sustainability**; one that would allow us collectively to stop, reflect, and retreat back within the planetary boundaries that protect Earth's natural life-support systems. Simultaneously, we want to ensure that we meet humanity's basic needs and aspirations. It is by integrating Earth systems with human welfare that we create the conditions for the flourishing and sustaining of life and civilization.

However, sustainability is a contested concept that is not yet anchored to a well-defined and consensual body of knowledge. It encompasses diverse and sometimes conflicting notions and approaches, each reflective of the relative importance assigned to environmental protection, social welfare, or economic growth, respectively. As indicated, the Sulitest model of sustainability is situated at the intersection of environmental and social sciences in what is considered an "embedded conceptualization" of sustainability (figure 1).

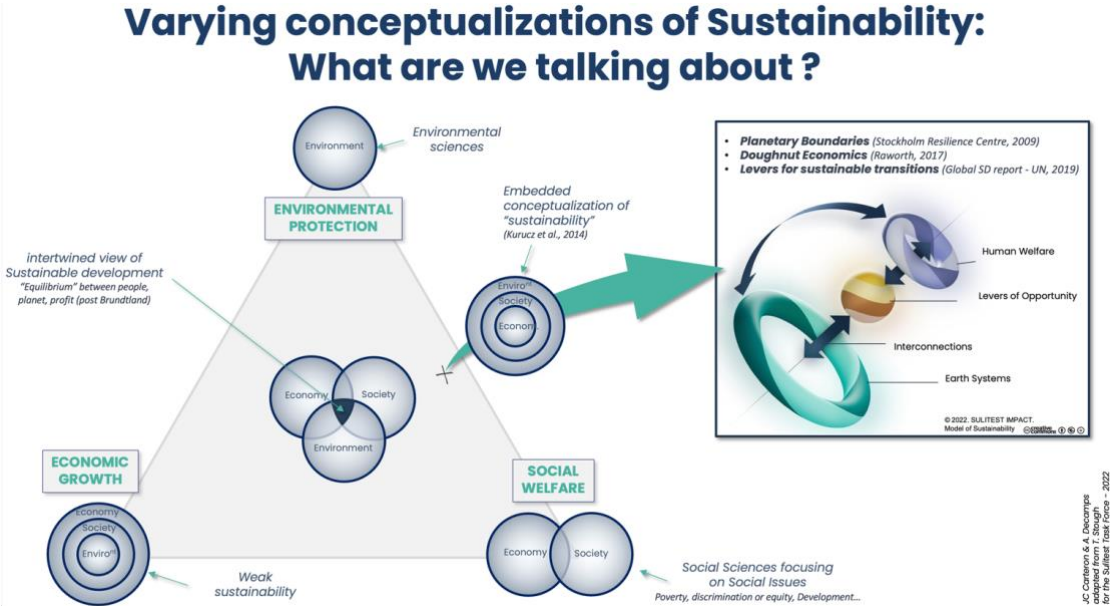


Figure 1. Different approaches to the interdependence of environmental, social, and economic systems

Defining sustainability knowledge therefore requires engaging with recent and relevant science-based literature and existing approaches, methodologies, and frameworks for sustainability. To this end, Sulitest created a "Task Force" of academics and sustainability professionals supported by an assembly of stakeholders—Sulitest "Fellows"—to document and ensure consistency in the selection and use of foundational concepts and resources. This year-long process also implied that Sulitest make conscious and intentional choices that necessarily situated Sulitest concepts, tools, and actions at specific locations within an existing field of sustainability and education for sustainability. As such, **we built our own model of sustainability knowledge, one that projects our vision of sustainability**.

The model of sustainability knowledge we have designed constitutes a bold vision for our world and shared future. It builds upon the embeddedness of Earth systems, upon a solid foundation of human welfare, and upon multiple levers of action and opportunity that make sustainability possible, although, alas, still uncertain. It requires that humans know and understand the multiple frameworks, domains, and subjects that constitute sustainability, as well as their systemic interlinkages of causality and impact. The Sulitest articulation of sustainability knowledge is a call for radical systemic change in what we need to know and understand in order to empower ourselves for the building of the sustainable future we want and need.

Main sources of conceptual inspiration

For the building of the Sulitest model, we conducted an extensive literature review of the many existing reports, tools, and frameworks on sustainability literacy, Education for Sustainability (EfS), Education for Sustainable Development (ESD), sustainability assessment, and related research on the topic. Having reviewed and evaluated existing knowledge in these fields, we began building our model with four main sources of inspiration.

I. **The UN 2030 Agenda for Sustainable Development**, which provides a common roadmap embracing the systemic nature of sustainability with 17 Sustainable Development Goals (SDGs) and 169 related targets. Holistic and integrated by design, the 17 SDGs (see below) reveal a systemic approach to sustainability via their multiple interlinkages, synergies, co-benefits, trickle-down effects, feedback loops, but also potential conflicts, trade-offs, and zero-sum gains (figure 2).

Embracing the systemic nature of sustainability therefore required science-based analysis and tools to navigate that complexity and to realize the ambition of the 2030 Agenda, as emphasized by the International Council for Science (Griggs et al., 2017) in the *Guide to SDG Interactions: From Science to Implementation*. It also

required a radical shift from business-as-usual "siloed" practices to unleash the profound and deep transformation that only close collaboration between multiple stakeholders can provide. This is further illustrated in the *Global Sustainable Development Report* (Messerli et al., 2019) which has also informed the Sulitest model and provides "a process for advancing collaboration among actors in science, Government, the private sector and civil society towards identifying and realizing concrete pathways for transformation driven by evidence."

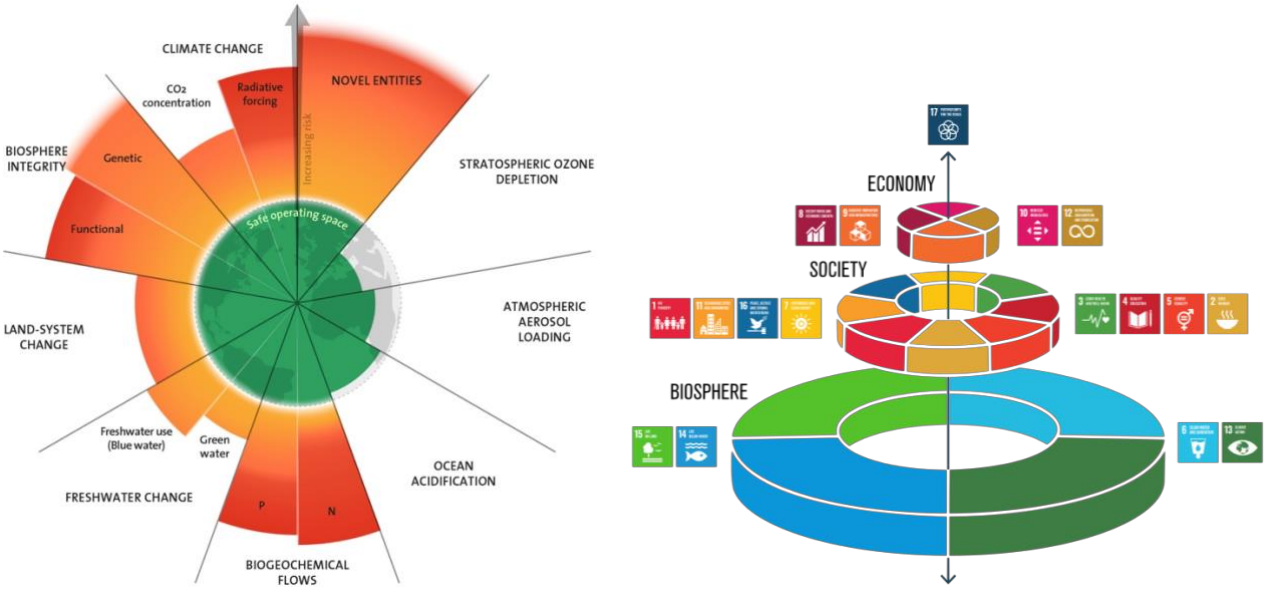
Figure 2. The United Nations' 17 Sustainable Development Goals (SDGs)

II. **The Planetary Boundaries framework by the Stockholm Resilience Center** which articulates a conceptualization of sustainability embedded into the environmental limits within which humanity can safely operate.

This framework (as shown below) identifies nine planetary boundaries that regulate the stability and resilience of the Earth system and provide a safe operating space for humanity to thrive. This approach has important implications for our conceptualization of sustainability and the role that humanity, society, and economy play within it, because they are all embedded within the Earth system and are therefore constrained by physical boundaries. One vivid illustration of this conceptualization comes from John Elkington, who questioned the validity of his own 1994 concept of the Triple Bottom Line (people, planet, and profit; or social, environmental, and economic impact). In 2018, Elkington expressed his growing doubt that such sustainability frameworks "will be enough, as long as they lack suitable pace and scale—the necessary radical intent—needed to stop us all overshooting our planetary boundaries" (Elkington, 2018).

Building on this embedded systems perspective, the Stockholm Centre further conceptualized the SDGs through a "wedding cake" model. In this representation

(figure 3), the Economy is embedded within Society, which is, in turn, embedded within the Biosphere. This visually reinforces the role of a healthy environment in achieving sustainable human development.



Framework I: The Planetary Boundaries. Licensed under CC BY-NC-ND 30. Credit: "Azote for Stockholm Resilience Centre, based on analysis in

Framework II: The SDG « Wedding cake » offering an integrated view of social, economic, and ecological development. Credit: Azote Images for Stockholm Resilience Centre, Stockholm

Figure 3. The Planetary Boundaries and the SDG Wedding Cake frameworks.

III. **The Kate Raworth Model of "Doughnut Economics"** provides a third framework the Sulitest Task Force used to delineate sustainability knowledge (figure 4). This model of sustainability holds that humanity might thrive beyond the 21st century by requiring that meeting human needs (the social foundation) remains subject to the ability of the living planet to provide for such needs (the ecological ceiling).

As such, the Doughnut Model builds on the planetary boundaries framework and consists of two concentric rings: a social foundation, to ensure that no one is left falling short of life's essentials; and an ecological ceiling, to ensure that humanity does not collectively overshoot the planetary boundaries that protect Earth's life-supporting systems. This model allows us to "rethink" the economy as a system that ethically should, and ecologically must, operate between these two boundaries—i.e., the doughnut-shaped space that is both ecologically safe and socially just: a space in which humanity can thrive.

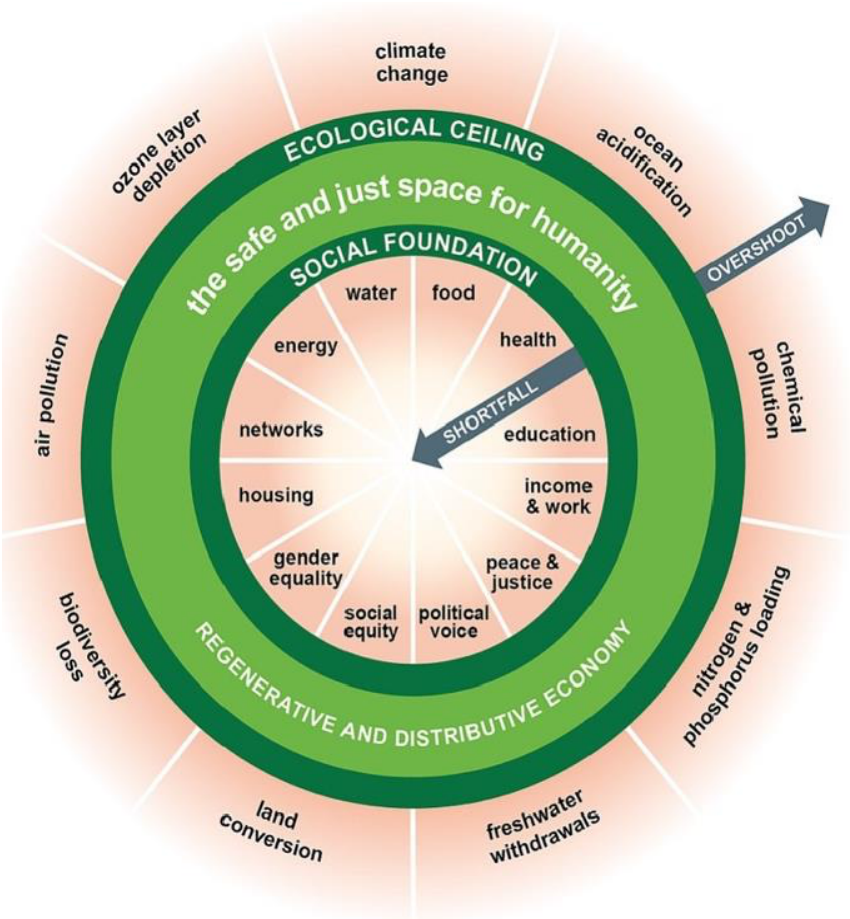


Figure 4. The Doughnut of social and planetary boundaries. Credit: Kate Raworth and Christian Guthier. CC-BY-SA 4.0

IV. **The UN's 2019 Global Sustainable Development Report**—*The Future Is Now: Science for Achieving Sustainable Development*—provides the fourth framework the Sulitest Task Force used to delineate sustainability knowledge by identifying drivers for transformative change. The report pinpoints four levers of action that support such transformation which we, at Sulitest, have adapted and integrated into our model: *Governance*; *Economy and Finance*; *Science and Technology*; and *Individual and Collective Action*.

The four levers should be regarded as the four "tools" or "instruments" that help us, as a society, identify and implement the solutions we need—both to hold ourselves within planetary boundaries and to consolidate our social foundations. Collectively, they are the human-devised institutions, policies, resources, means, agents, processes, cognitive models, and techniques of transformative change. They provide the opportunity to find solutions to our most pressing and wicked problems.

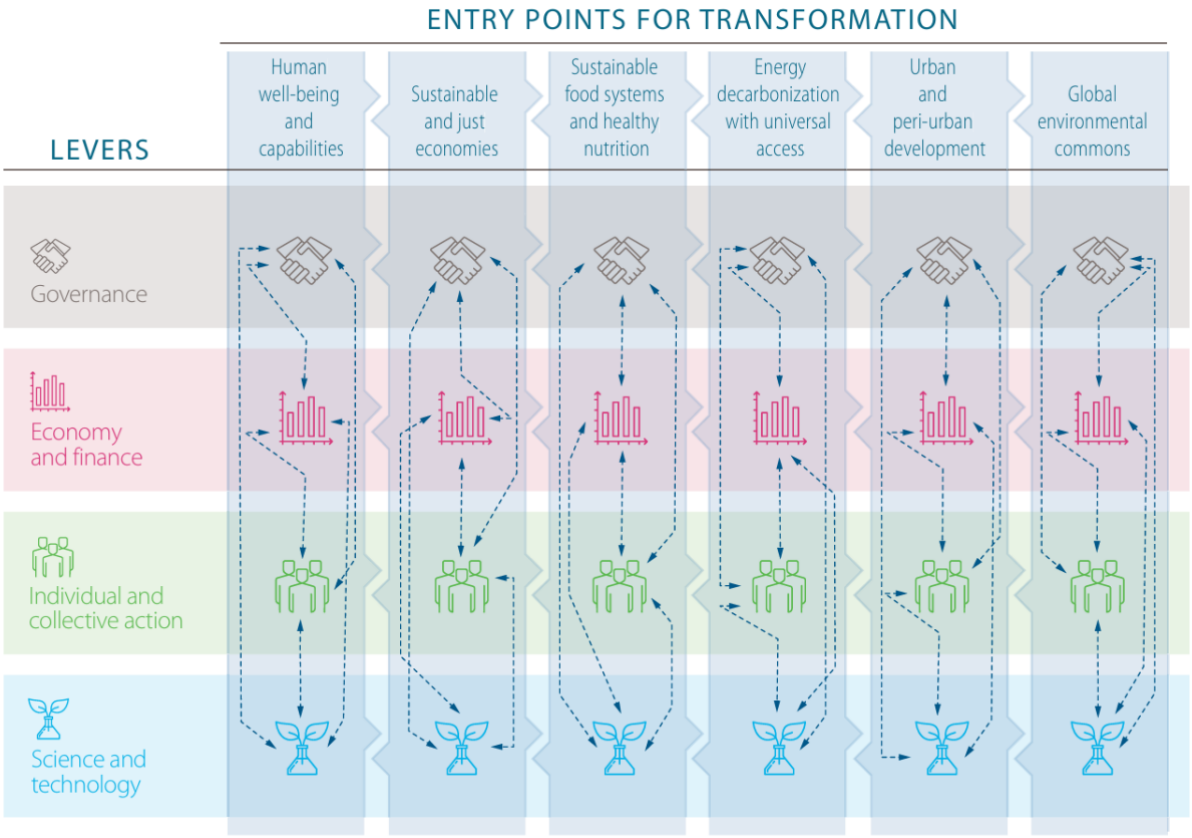


Figure 5. Entry points and levers for Transformation. Messerli et al. Global Sustainable Development Report 2019: The Future is Now – Science for Achieving Sustainable Development, (United Nations, New York, 2019), xxii.

Structuring and operationalizing our model in a foundational matrix

Combining these sources of inspiration with the existing literature in the fields of sustainability and education for sustainability, the Task Force structured the model of sustainability knowledge into a foundational matrix. This matrix seeks to articulate the inspirational frameworks previously mentioned within a coherent model, enriched with our own vision of sustainability knowledge.

This model of knowledge is not specific to a discipline or a sector but follows the thematic, integrated, embedded, and systemic nature of sustainability literacy.

Our model of sustainability knowledge

All individuals should know and understand planetary boundaries, the social foundations of human welfare, the levers of action and opportunity that inform and influence our ability to build a sustainable future, and the systemic interlinkages existing between and across them.

This model of sustainability knowledge is operationalized via a foundational *Matrix of Sustainability Knowledge* organized into three *Frameworks*:

1. **Earth Systems** — This Framework includes two *Domains*: *Core Planetary Boundaries* and *Regulating Planetary Boundaries*, both of which indicate the safe operating space for humanity. Together, these *Domains* constitute The Environmental Ceiling of the Earth Systems *Framework*.

2. **Human Welfare** — This Framework includes three *Domains*: *Safety and Basic Needs* for all, *Social Welfare* for people, and elements that contribute to *Human Flourishing*. Together, these Domains constitute The Social Foundation of the Human Welfare *Framework*.

3. **Levers of Opportunity** — This Framework includes four *Domains*: *Governance, Economy and Finance, Science and Technology,* and *Individual and Collective Action*. Together, these *Domains* indicate The Levers of Opportunity or action that make sustainability possible, although, still uncertain, through entry points for transformation.

The TASK™ Model of Sustainability Knowledge can be represented as a visual schematic designed to inform how we think about the structure and interactions of the three frameworks. The model reveals the influence of both the Kate Raworth concept of "doughnut" economics and the embedded conceptualization of sustainability inspired by the Stockholm Resilience Center's schematic on planetary boundaries.

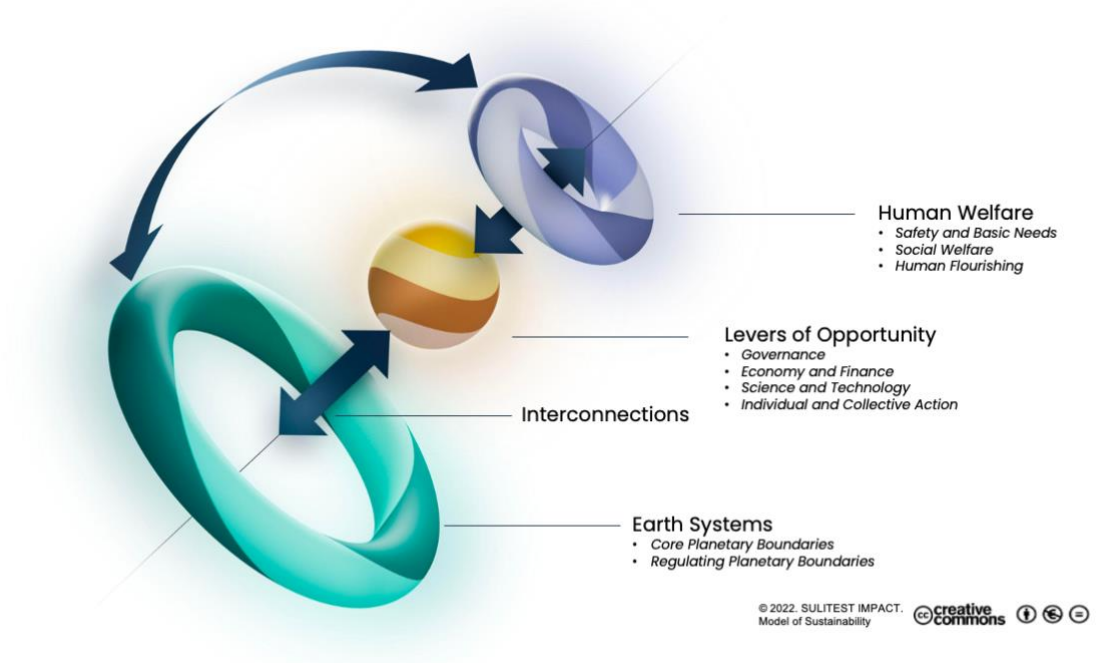


Figure 6. The Sulitest Impact Model of Sustainability.

In the model, *Earth Systems* is schematically presented as the largest because the other two frameworks—*Human Welfare*, and *Levers of Opportunity*—depend upon, and are embedded within it. Without a stable and sustainable Earth system, there can be no meaningful human welfare nor levers of opportunity to seize. As mentioned, the framework of Earth Systems is comprised of two domains: *Core Planetary Boundaries* and *Regulating Planetary Boundaries.*

The second framework—that of *Human Welfare*—is conceptually embedded in *Earth Systems,* given that humans are but one species in the community of life, and that the pursuit of such human welfare cannot exceed the capacity of the Earth to provide for the welfare of all life-forms. The framework of *Human Welfare* builds upon the framework of the Sustainable Development Goals (SDGs) comprises of three domains: *Safety and Basic Needs*, *Social Welfare*, and *Human Flourishing*.

The sphere in yellow in the middle represents the *Levers of Opportunity* that act upon both *Earth Systems* and *Human Welfare*. These levers are the many individual and collective public policies and processes, as well as cognitive capacities, at humanity's disposal for making decisions and taking actions that either advance or, alas, impede progress towards sustainability. Situated between the environmental ceiling and the social foundation, these levers are activated through entry points for transformation. They offer human societies the opportunity to act in ways that ensure their well-being while respecting the boundaries of Earth system integrity.

The straight and curved arrows in the schematic indicate the many direct and indirect relationships, interconnections, causal relationships, systemic impacts, and feedback loops both within and across the three frameworks.

II. Mapping Sustainability Knowledge onto the TASK™ Matrix

The model described here is designed to help us retain a visual image of what constitutes sustainability knowledge whereas the *Matrix of Sustainability Knowledge* (presented below in table 1) presents a more complete picture both of the detailed content of sustainability knowledge, as designed by the Sulitest Task Force, as well as the organizational structure of the TASK™ assessment questions and the corresponding sequenced process used for asking them.

The three frameworks and nine domains we reviewed in the graphic model appear on the left side of the matrix. However, for each of the nine domains, the matrix lists and numbers the specific *Subjects—i.e.*, the corresponding topical content included

in each knowledge domain. As indicated, there are nine subjects directly related to *Earth Systems* (Steffen et al, 2015); eleven related to *Human Welfare* (adapted from Raworth, 2017 and the UN framework of the Sustainable Development Goals); and eight related to *Levers of Opportunity* (Messerli et al, 2019). Together, the 28 subjects constitute a structured vision of what the Sulitest Task Force intentionally chose to include in its concept of sustainability knowledge. More importantly, it is these 28 subjects, combined into 9 domains, and aggregated into 3 frameworks that TASK™ assesses.

As also designed by the Sulitest Task Force, and as indicated in the matrix, there are **four discrete types of sustainability knowledge** assessed by TASK™: descriptive, contextualized, causal, and integrated. Each type is organized under one of two unifying forms of human cognition: *Knowing and Understanding*, and *Interlinkages*. The two forms of cognition and four types of knowledge are the following:

1. Knowing and Understanding	**2. Interlinkages**
i. Descriptive knowledge	iii. Causal knowledge
ii. Contextualized knowledge	iv. Integrated knowledge

As indicated in the matrix, sustainability knowledge related to the 20 specific subjects of *Earth Systems* and *Human Welfare* is organized across all four types of knowledge. Within epistemology, the types of knowledge are differentiated between propositional knowledge (also referred to as *descriptive knowledge*) and non-propositional knowledge (which includes *knowledge-how* and *knowledge by acquaintance,* referring to familiarity with a topic that results from experience with another topic). Both types of knowledge are considered forms of cognitive success (Burgin, 2016; Steup & Neta, 2005).

Our model organizes these different types of cognition into a sequential process that ensures coherence and consistency throughout the assessment exercise: encountering questions about knowing and understanding the matrix subjects comes first, before encountering more complex questions that explore the systemic interlinkages between the matrix subjects, domains, and frameworks. The actual sequencing of the question-asking is indicated on the matrix by letters A through E, consecutively.

As also indicated in the matrix, the first two *Frameworks* are threshold-based, constituted as they are by a set of boundaries for both **Earth Systems** (a "ceiling") and **Human Welfare** (a "foundation"). As such, in our model of sustainability knowledge, the 20 subjects of these two frameworks are tested across all four types

(or categories) of knowledge: descriptive, contextualized, causal, and integrated. When creating questions for each of these categories, the Task Force articulated guidelines for distinguishing among the types of knowledge. The descriptors and signifiers used to inform the question design process are the following:

1.1 — Definitions and Key Concepts — Descriptive Knowledge
What are we talking about? How does this work?
i.e., identify & describe principles, states, functions, processes, and concepts

1.2 — Current State and Trends — Contextualized Knowledge
Where are we now? How are things changing?
i.e., identify & describe evolving states, change processes, mutation of processes

2.1 — Major Causes — Causal Knowledge
Why is this happening? Who is doing what and why?
i.e., identify & describe drivers, factors, and forcings of boundary transgression

2.2 — Systemic Impacts — Integrated Knowledge
What are the related effects? How is this affecting the larger system?
i.e., identify & describe impacts of boundary transgression on other concepts.

The third framework of the matrix—*Levers of Opportunity*—is conceptually different in nature from the other two. It represents the many levers of action—*i.e.*, human-made systems—that provide us with opportunities to act on sustainability in ways that enable or hinder our ability to build a sustainable future. For each of the four levers and corresponding eight subjects, the TASK™ model of sustainability knowledge and corresponding assessment questions focus upon descriptive knowledge and contextualized in the following way:

1.1 — Definitions and Key Concepts — Descriptive Knowledge
What are we talking about? How does this work?
i.e., identify & describe the principles and functions of the main levers

1.2 — Current State and Trends — Contextualized Knowledge
Where are we now? How are things changing?
i.e., identify & describe evolving processes and effects of using such levers

In conclusion, the resulting Sulitest matrix consists of 3 higher-order *Frameworks* (e.g., Earth Systems); 9 second-order *Domains* (e.g., Core Planetary Boundaries); 28 third-order *Subjects* (e.g., Climate Change); and 96 test *Items* at the most granular level (e.g., Definition of climate change), as indicated in Table 1. **This foundational matrix expresses our vision of sustainability knowledge**.

As a new and innovative method for measuring the sustainability knowledge of both individuals and organizations for the 21st Century, TASK™ is now providing a robust, science-based, and comparable assessment process that **will make this approach to sustainability knowledge the new standard in sustainability literacy.**

TASK™ Matrix by Sulitest

Sustainability Knowledge

Framework	Domain	Subject		x.1. **Knowing and Understanding**		x.2. **Interlinkages**	
				x.1.1 **Definitions and Key Concepts** *Descriptive Knowledge* What are we talking about? How does this work?		x.2.1 **Major Causes** *Causal Knowledge* Why is this happening? Who is doing what and why?	x.2.2 **Systemic Impacts** *Integrated Knowledge* What are the related effects? How is this affecting the larger system?
1. Earth Systems The Environmental Ceiling	1.1 Core Planetary Boundaries	1.1.1 Climate Change		1.1.1.1.1	1.1.1.1.2	1.1.1.2.1	1.1.1.2.2
		1.1.2 Biosphere Integrity		1.1.2.1.1	1.1.2.1.2	1.1.2.2.1	1.1.2.2.2
	1.2 Regulating Planetary Boundaries	1.2.1 Freshwater Use		1.2.1.1.1	1.2.1.1.2	1.2.1.2.1	1.2.1.2.2
		1.2.2 Land-System Change		1.2.2.1.1	1.2.2.1.2	1.2.2.2.1	1.2.2.2.2
		1.2.3 Ocean Acidification		1.2.3.1.1	1.2.3.1.2	1.2.3.2.1	1.2.3.2.2
		1.2.4 Novel Entities		1.2.4.1.1	1.2.4.1.2	1.2.4.2.1	1.2.4.2.2
		1.2.5 Biogeochemical Flows		1.2.5.1.1	1.2.5.1.2	1.2.5.2.1	1.2.5.2.2
		1.2.6 Atmospheric Aerosols Loading		1.2.6.1.1	1.2.6.1.2	1.2.6.2.1	1.2.6.2.2
		1.2.7 Stratospheric Ozone Depletion		1.2.7.1.1	1.2.7.1.2	1.2.7.2.1	1.2.7.2.2
2. Human Welfare The Social Foundation	2.1 Safety and Basic Needs	2.1.1 Nutrition	A	2.1.1.1.1	2.1.1.1.2	2.1.1.2.1	2.1.1.2.2
		2.1.2 Health		2.1.2.1.1	2.1.2.1.2	2.1.2.2.1	2.1.2.2.2
		2.1.3 Access to Water and Sanitation		2.1.3.1.1	2.1.3.1.2	2.1.3.2.1	2.1.3.2.2
		2.1.4 Housing and Human Settlements		2.1.4.1.1	2.1.4.1.2	2.1.4.2.1	2.1.4.2.2
		2.1.5 Access to Energy		2.1.5.1.1	2.1.5.1.2	2.1.5.2.1	2.1.5.2.2
	2.2 Social Welfare	2.2.1 Basic Income and Decent Work		2.2.1.1.1	2.2.1.1.2	2.2.1.2.1	2.2.1.2.2
		2.2.2 Social Equity		2.2.2.1.1	2.2.2.1.2	2.2.2.2.1	2.2.2.2.2
		2.2.3 Gender Equality		2.2.3.1.1	2.2.3.1.2	2.2.3.2.1	2.2.3.2.2
	2.3 Human Flourishing	2.3.1 Education and Culture		2.3.1.1.1	2.3.1.1.2	2.3.1.2.1	2.3.1.2.2
		2.3.2 Peace, Justice, and Political Voice		2.3.2.1.1	2.3.2.1.2	2.3.2.2.1	2.3.2.2.2
		2.3.3 Access to Networks and Social Interaction		2.3.3.1.1	2.3.3.1.2	2.3.3.2.1	2.3.3.2.2
3. Levers of Opportunity That Make Sustainability Possible	3.1 Governance	3.1.1 Laws, Policies, and Institutions	B	3.1.1.1.1	3.1.1.1.2	*N.B. Letters indicate the order in which TASK questions appear in the assessment. Within each lettered category, TASK questions are randomized.*	
		3.1.2 Infrastructure, Planning, & Natural Resource Management		3.1.2.1.1	3.1.2.1.2		
	3.2 Economy and Finance	3.2.1 Macroeconomic Considerations and Finance		3.2.1.1.1	3.2.1.1.2		
		3.2.2 Microeconomic Considerations, Business, and Industry		3.2.2.1.1	3.2.2.1.2		
	3.3 Science and Technology	3.3.1 Sustainability Science		3.3.1.1.1	3.3.1.1.2		
		3.3.2 Technology and Innovation		3.3.2.1.1	3.3.2.1.2		
	3.4 Individual and Collective Action	3.4.1 Transformative Change		3.4.1.1.1	3.4.1.1.2		
		3.4.2 Cognitive Capacity for Sustainability		3.4.2.1.1	3.4.2.1.2	*© 2023 Sulitest TM - V1-En: 2023/03/01*	

Table 1. TASK™ Matrix by Sulitest

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