

People Systems
 Environment Trash
 Nutrients Transition
 Growth Ecofriendly
 Mess Partnerships
 Vision Production
 Designers Wickedly
 Cradle to Cradle
 Wicked Problem
 Consumerism
 Prosperity Mess
 Compost Garbage
 Reuse Waste Circular
 Interconnected
 Consumerism
 Circular Production
 Regenerative
 Perceived Obsolescence
 Ecodesign
 Interconnected
 Designers

Durable Pollution
 Landfill Ecofriendly
 Environmental Growth
 Global Partnerships
 Reduce Collaboration
 Repair Ecodesign
 Future Incinerator
 Repurpose Repair
 Mess Transition

Disposal Design
 Reuse Incinerator
 Compost Prosperity
 Collaboration
 Perceived Obsolescence
 Repurpose Landfill
 Garbage Planet
 Recycle Biodegradable
 Planned Obsolescence

Repair Durable
 Transition Future
 Repurpose People
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Wicked Problem Systems
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Beyond the Waste

Uncovering Layers of Sustainability

Surbhi Ribadiya

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SUST 704 | Applied Theories in Sustainability

Instructor : Prof. Scott Bolyston



PREFACE

As a child, I was messy! My cupboard was never tidy, while my sister on the other hand, a clean freak, kept everything organized in a pretty systematic way that anyone can find anything out of her cupboard in a matter of seconds. Even though I always knew where to find my stuff, I realized it's equally important for others to locate them and to communicate the unspoken through an organized layout. From a young age, I learned that anything following a system is more likely to reach its intended destination than a heap of unorganized chaos. Here, there are two parallels I'd like to emphasize: as humans, we have created, and continue to create, two incredibly dangerous forms of chaos: "Waste" and "Mess."

We all know that humans invented waste, there's no waste in nature. And while we can't simply stop an 8-billion-strong world from generating waste, we can at least avoid turning it into an even bigger mess. Waste itself is already chaotic, and making it more disorganized only makes our path out of it more difficult. Think about clearing snow from the top of your car after a snowfall or tidying a cluttered computer desk. If you don't take the time to clear or organize it right away, it piles up, becoming bigger, harder, and more time-consuming to handle. Not to mention, important projects might be paused because of missing items buried somewhere in that mess, or worse, things you didn't even realize were there.

Right now, we're living in a world of crises, a climate crisis and all the factors that contribute to it. One of the biggest is undoubtedly the waste we're generating and dumping. This waste crisis is a wicked problem, one we've yet to find a way to truly solve. Waste, of all kinds and in all forms, is already part of the crisis, and continually adding to it only complicates and slows down our path to a brighter future. We need to stop this, and we need to do it faster than ever and more effectively.

This journal is a biography of my journey in sustainability, an attempt to connect my understanding of sustainable approaches to the urgent issue of waste generation and management. It aims to spread awareness among readers about the potential impact they hold in their daily roles, both as individuals and as part of a global community. Through this exploration, I hope to inspire others to recognize their role in building a more sustainable future.

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CONTENTS

1. A Sustainable Vision The Power of Small Units Waste and the Future Realigning Priorities	1
2. Origins of a Crisis The Roots of Unsustainability Shaping Change Designing to Discard	7
3. Towards a New Economy Beneath the Surface Beyond the Expansion Model Economic Boundaries	13
4. Growth to Development The Story of Human Potential Envisioning the Future Pioneering Profit with Purpose	19
5. Regulating Change Sounding the Alarm The Blueprint of Sustainable Development Validating Sustainability Claims Global Development Goals	27
6. Waste as Resource Closing the Loop Designer's as Alchemist Catalyzing Change	35
Conclusion	43

System Traps

Policy Resistance: This occurs when various actors in a system pull in different directions, often resulting in gridlock. Conflicting interests, such as recycling initiatives versus industries favoring disposables, stall waste reduction efforts and create policy deadlock.

Tragedy of the Commons: This trap happens when individuals overuse a shared resource in lack of incentive to conserve. Individuals and businesses overuse landfill space, leading to overflow and environmental harm.

Drift to Low Performance: This is the gradual lowering of standards until poor performance becomes normalized. When communities gradually relax recycling standards, contaminated waste streams increase, undermining recycling efforts.

Escalation: This trap involves a reinforcing feedback loop of competition, with aggressive responses from competitors to win. Companies compete in packaging, leading to more single-use, non-recyclable materials, which escalates waste production.

Success to the Successful: This occurs when initial advantages compound over time, leading to increasing inequality. Wealthy neighborhoods attract more investment and improvements, while poorer areas decline, widening the gap between them.

Shifting the Burden: Short-term solutions like incineration reduce landfill waste temporarily but distract from long-term sustainable practices, worsening environmental issues.

Rule Beating: Finding ways to get around the intent of a system's rules without technically breaking them. Companies exploit loopholes, marketing "recyclable" packaging that requires special facilities, misleading consumers while the packaging ends up in landfills.

Seeking the Wrong Goal: A system is optimized for the wrong metric. Waste systems that focus only on reducing landfill volume may promote incineration or waste exports.

Leverage Points

Numbers: Constants and parameters in a system, such as tax rates or speed limits. Easy to change but with limited impact on system behavior.

Buffers: Sizes of stabilizing stocks compared to flows. Like water reservoir size compared to water use affects the system's resilience to drought.

Stock-and-Flow Structures: Physical systems and their intersections, like road networks, which shape long-term system behavior.

Delays: The lengths of time relative to the rates of system changes. Such as the gap between carbon reduction measures and visible climate impact.

Balancing Feedback Loops: The strength of the feedbacks relative to the impacts they are trying to correct, like thermostats adjusting room temperature.

Reinforcing Feedback Loops: The strength of the gain of driving loops. Amplifying cycles, such as population growth driven by job availability.

Information Flows: This refers to the structure of who does and does not have access to information, like transparency in government decisions.

Rules: These are the incentives, punishments, and constraints that guide system behavior, like building codes or environmental regulations.

Self-Organization: This is the power to add, change, or evolve system structure, seen in grassroots initiatives.

Goals: This refers to the purpose or function of the system. Such as maximizing peoples' quality of life and well-being.

Paradigms: The mindsets out of which the system arises. Like a shift from car-centric to pedestrian-friendly urban design.

Transcending Paradigms: This is the ability to move flexibly beyond fixed mindsets for innovative problem-solving.

FOREWORD

We live in a world of complex systems and, simultaneously, a world in crisis. Complex systems refer to the structures and processes, both natural and manmade, that sustain our lives. These systems consist of numerous interconnected elements that rely on one another to achieve specific purposes. To find balance within such systems, it is essential to understand the individual components, their behaviors, and the relationships between them, while also considering the broader context of the challenges they face.

In 1993, Donella Meadows began drafting *Thinking in Systems*, aiming to simplify the methods for understanding and solving such complex systems. This journal applies systems thinking as a framework to evaluate intricate systems like waste management, while integrating supporting theories for designing solutions that promote sustainability.

“an interconnected set of elements that is coherently organized in a way that achieves something. ... a system must consist of three kinds of things: elements, interconnections and a function or purpose.”

Thinking in Systems introduces key concepts such as feedback loops, stocks, and flows, emphasizing the importance of understanding the structure of systems rather than focusing on isolated events. No matter how well a system is performing, there are always underlying problems or errors, which Meadows categorizes as system traps. To address these issues, one must identify leverage points—specific aspects of a system that have more influence on the system's behavior compared to others. Meadows discusses nine common system traps and highlights twelve leverage points that can be used as solutions.

“Mental models are mostly invisible to us, until we look for them. The more you work with systems, the more you begin to see them everywhere” She explains that our interpretation of systems and the constant updating of our understanding and decisions are shaped by mental models. These models are formed through our perceptions of the system and its associated traps, allowing us to challenge and revise them. Meadows argues that some of the most effective leverage points for transforming systems lie in recognizing and altering the mental models that guide our actions and decisions. As we explore waste as a complex global system in crisis, we may encounter several elements from systems thinking that can broaden our understanding of our role within the system and help us find a way out. This begins with recognizing our own mental models, both as individuals and as part of the larger community and addressing the changes needed.



1. A Sustainable Vision

My parents built a house on the outskirts of Surendranagar, a small city in western India, just as I was about to enter this world. I lived in that house for about 20 years, until I moved to a new city for further education. I often referred to the house as my “birthday twin,” since we shared the same birth year. The house was located next to a large railway property, a piece of land reserved for potential housing quarters for the railway in the coming century. Over time, the abandoned space became a magnet for trash, serving as a dumping ground for things society didn’t know what to do with—waste that had no place in our beautiful homes.

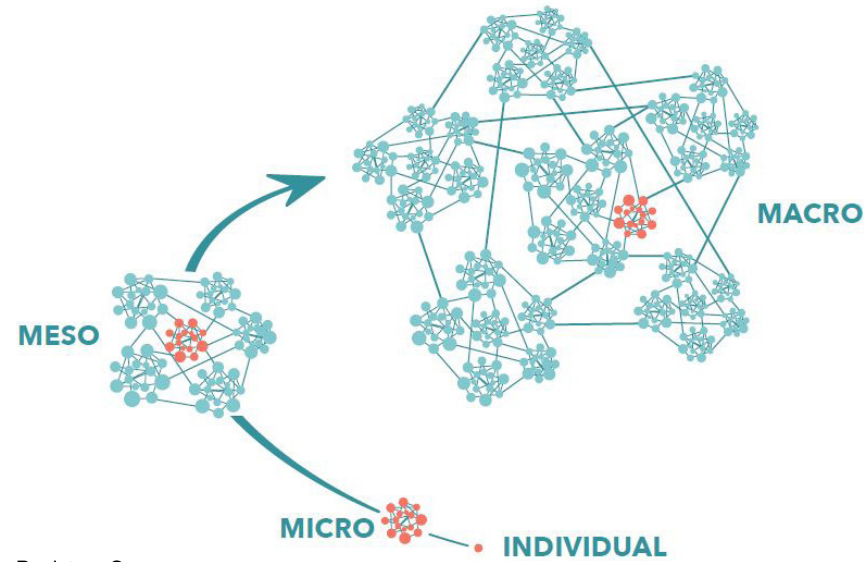
It wasn’t just the landfill next to my house that prompted me to write about this issue. Throughout my journey on Earth, I’ve witnessed how we humans are conditioned to dispose of waste without a second thought. Whether it’s throwing trash out the window while traveling, spitting in public spaces, or countless other careless habits, the list of our wasteful behaviors stretches far beyond what we can even comprehend.

So, what is “waste” or “garbage” in this context? It’s something discarded by people, by us, humans, because we no longer see value in it for its original purpose. Repurposing isn’t something we, as a species, have excelled at, especially when we consider the enormous amount of waste we generate daily.

Nature, on the other hand, doesn’t produce waste. Even by-products serve a purpose, what we might consider waste in our systems is often a nutrient, food, or base for another natural cycle. Nature has remarkable processes like evaporation and rainfall, which turn something that’s changed form into something fresh again. It maintains balance by keeping everything interconnected, and it shows us that imbalance in one part of the system inevitably leads to disruption in others, jeopardizing the entire cycle of healing and regeneration.

The Power of Small Units

Exploring Holarchies in waste system



Boylston, S.

Now, you might be wondering: what role does an individual, a family, or even society play in the waste system? Have you ever had a moment of inner conflict, wondering if your actions matter in the grand scheme of things, especially when you're just one small, innocent part of a much larger system? Let's explore this further, particularly when we consider the concept of "holarchies" within a system.

A holarchy is a system in which each cell or unit is both a whole in itself and a part of a larger body or group, playing a significant role within it. Each unit is as strong as it can be on its own, but its power intensifies when it connects with other units at different levels. In this system, the individual parts are interdependent, and their collective actions amplify the impact on larger systems, multiplying and increasing the magnitude of the effect.

Imagine a waste bin in your room as an individual unit, which then gets emptied into the larger bin of your house, and further into an even bigger bin at the community or societal level. This process eventually contributes to massive structures like landfill mountains, floating garbage islands, incinerators releasing tons of harmful pollution, and the contamination of inland water bodies, water that was once meant to provide fresh drinking supplies for millions of people. Waste is not an isolated entity; it interacts with the physical environment at every step, and its impact grows stronger as it moves through the levels of the holarchy system.

"Many drops make a mighty ocean." It is the collective power of many small individuals that come together to form an enormous group, one that seems limitless unless we actively stop adding more individuals—or micro, meso, and macro units to the system. Limiting growth is the key to preventing the destructive outcome that lies ahead, much like the group of MIT scientists who, in 1972, explored this idea in their groundbreaking work, Limits to Growth.

System Trap: Drifting to Low Performance

Imagine a city where recycling bins are placed all around, but over the years, people start to feel that their recycling contributions don't make a real impact. "What difference does my one bag make?" becomes a common sentiment. Soon, more residents begin tossing recyclables in with general waste, convinced their small actions are insignificant in the larger system. As more people adopt this view, recycling participation drops, and waste contamination increases.

City officials address the overflow by simply increasing waste collection instead of tackling the root issue. Gradually, recycling becomes optional, normalizing lower standards of waste management. This drift to low performance shows how individual disengagement can, over time, lower the entire system's effectiveness.

Waste and the Future

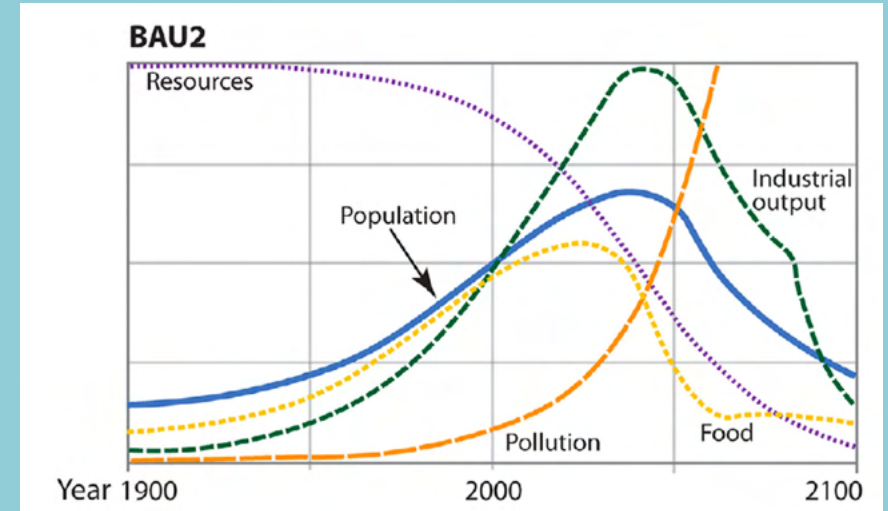
Lessons from Growth Models

What we take from the Earth, resources to generate energy, food, products, and everything we need to survive, is not infinite. To continue receiving, we must also give back. However, this "giving back" cannot mean a mountain of garbage that is not easily degradable, or in some cases, not degradable at all. Such waste disrupts and significantly slows down nature's cycle of regenerating resources.

In 1972, a group of MIT scientists developed a global computer model to assess the implications of economic and population growth patterns and predict future scenarios for human survival. The study revealed

that if we continue using resources and growing at the same rate, we are likely to face civilizational collapse. The study focused on five key factors: population growth, agricultural production, nonrenewable resource depletion, industrial output, and pollution generation, and sought solutions to ensure a sustainable future for humanity.

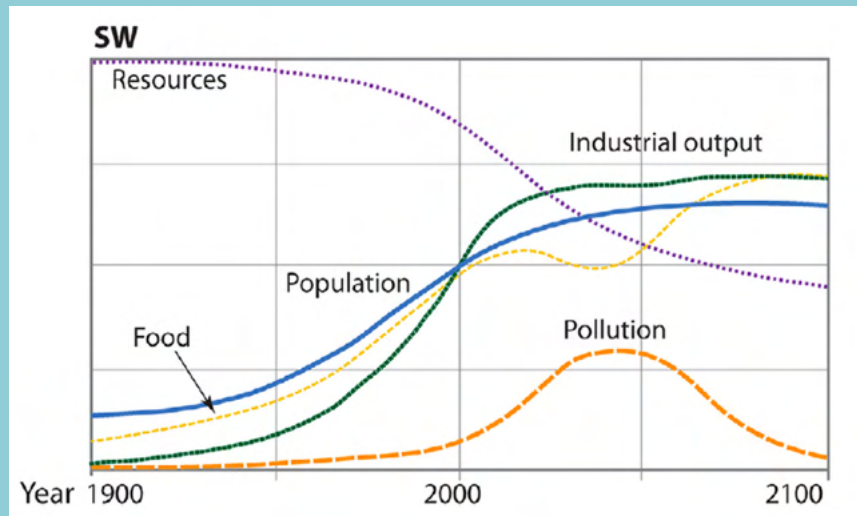
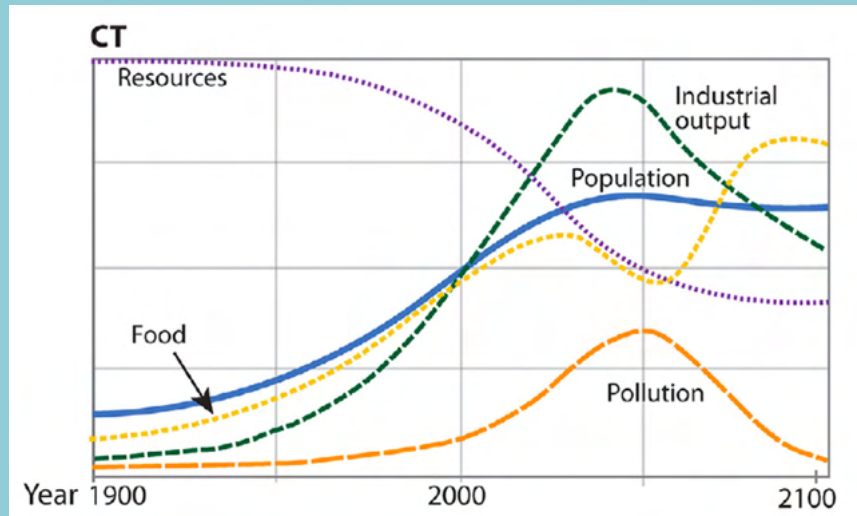
These factors are deeply interconnected with the waste system, highlighting how waste, as an entity, is linked to each of them. If we act wisely, we have the potential to create significant change.



Herrington, 2021. 2020 Updates on Limits to Growth

The study explicitly ruled out the Business-as-Usual (BAU) scenario, asserting that such a path is unsustainable for our survival. We cannot continue to pursue growth in all areas without considering its larger implications for the environment and society.

Realigning Priorities



Herrington, 2021. 2020 Updates on Limits to Growth

Two other models of growth, Comprehensive Technology (CT) and Stabilized World (SW), offer better prospects for survival, albeit with different scales of struggle as a byproduct of our current growth patterns. The CT model acknowledges potential negative consequences but provides a path toward survival. The SW model, the most beneficial with the least consequences, sets a sustainable course for survival. Although current patterns are far from aligning with the SW model, we can still aim higher.

The growth of waste is a major culprit, and limiting it through proper waste management is the path forward. This journal ahead, aims to address this by exploring the various relationships waste is associated with and the impacts it creates.

Every step we take counts, and the journey ahead can lead to a more sustainable future. These two models offer a roadmap for change, suggesting that immediate action is necessary to reduce risks and work toward a brighter future, one where growth is balanced and in harmony with our one and only home—Earth.

As we look toward pathways for balanced growth and waste management, it's essential to consider guiding frameworks for sustainable development. One of the most influential of these is Our Common Future, also known as the Brundtland Report. It was published in 1987 by the United Nations World Commission on Environment and Development (WCED). The report introduced a widely referenced definition of sustainable development that continues to guide developers in their pursuit of a sustainable path.

“Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs.”

By addressing present needs through the lens of a lasting ecosystem, the report underscores sustainability as a fundamental commitment. It envisions a brighter future—a way of living in harmony with nature. Rather than halting growth, the report advocates for reimagining it to find a balance between sustainable development and environmental resources. This involves expanding the resource base, including consideration for the afterlife of the products we design, so that each product can complete a cycle and contribute to the creation of new resources. Ultimately, it is about ensuring “sustainable human progress and human survival.”

The report provides insights and perspectives on the bigger picture by defining the global challenges we face. While some successes can be found along the way, failures have been more prevalent. By identifying these shortcomings as failures in development and in managing the human environment, the report raises awareness of the limitations of human civilization in balancing its own activities.

The challenges highlighted—ranging from poverty and hunger to pollution of land and water, ozone depletion, acid rain, and more, are closely tied to the waste generated by industries and various human activities that often fail to consider the broader implications of decisions made by individuals and organizations alike. The climate crisis and its contributors are deeply interconnected; there is no separate environmental or economic crisis. Addressing one can impact the other, underscoring the need for sustainable development and shifts in policy.

Global partnerships and shifts in governmental goals are crucial for implementing necessary changes. These entities play a vital role in allocating resources and guiding populations toward more sustainable practices. Prioritizing resources for critical areas such as environmental protection, agricultural development, health, and education, rather than military expansion or GDP growth, can support a more sustainable and equitable future.



2. Origins of a Crisis

Have you ever wondered where it all began? From what I know, humans who existed before Homo sapiens survived longer than we have, despite experiencing societal collapses for various reasons. But we, Homo sapiens—the so-called “Wise Man”—weren’t always on the path of desperately destroying our planet. Our home has an innate ability to heal itself, allowing us to live within it by using its resources, which are regenerated in a way that balances the nutrients on Earth.

So, what brought us to where we are now? Perhaps it’s the Industrial Revolution, population growth, or an insatiable hunger for progress, or maybe all of these factors combined. But if we look back, we weren’t always like this. We shifted from a culture of frugality to an endless cycle of consumerism. This transformation marked a significant shift in social and economic values, where a cultural emphasis on careful spending, resourcefulness, and thrift gave way to a desire for abundance, materialism, and disposable products. This change often accompanies industrial growth, rising wealth, and an expanding availability of goods, which together fostered a consumer-driven mindset.

To understand how we got here, we need to look at the key shifts that led us down this path. The Industrial Revolution changed everything, transforming our relationship with nature and the resources we once used more carefully. With each new technology, society moved further from the natural cycles that had sustained us for generations. Economic growth became the focus, and we began to see resources as limitless and environmental impacts as minor. As industries and cities expanded, so did the idea that progress meant constant consumption. This chapter explores the social, economic, and cultural changes that took us from balanced resource use to the unchecked consumerism that defines our modern age.

“Big Here - Long Now”

The concept of “Big Here, Long Now” was coined to describe a mindset that emphasizes short-term thinking, prioritizing immediate needs, desires, and gratification (“Big Here”) over long-term sustainability and consideration for future generations (“Long Now”). In contrast to the “Big Here” focus on the now, “Long Now” encourages us to think ahead, considering how today’s decisions will affect the planet, society, and resources far beyond the present moment.

By focusing on the “Big Here,” we tend to overlook how today’s decisions—whether about consumption, waste, or resource use, will affect future generations. Shifting away from “Big Here” thinking to embrace The Long Now requires recognizing the interconnectedness of our actions across time and how they will influence the world in the distant future. This shift can help guide more sustainable practices that address current needs without jeopardizing the resources and systems that future generations will depend on.



To understand the role of design in shaping our current way of living, Buchanan identified four primary domains of design: Visual and communication, Material objects, Activities and organized services, and Complex systems or environments for living, working, playing, and learning. While it may be tempting to treat these domains as separate entities, such as graphic designers, industrial designers, managers, architects, and urban planners—they are, in fact, interrelated. All design domains can benefit from the collaborative work of various design experts.

Instead of treating them as isolated fields, “the sequence of signs, things, actions, and thought could be regarded as an ascent from confusing parts to orderly wholes.” This approach suggests a path where we utilize the strengths of all design domains to address complex systems and improve outcomes.

The boundaries that once separated different design categories and experts are now blurring, providing a broader umbrella for innovation. For tackling complex wicked problems, solutions must integrate all design domains, reflecting the necessary shifts and changes for improvement.

Design thinking can drive meaningful change, but what’s essential is guiding that change in a positive direction to increase our chances of survival. The goal is to find long-lasting solutions that focus on the bigger picture, rather than worsening the situation with more devastating outcomes and challenges.

The wicked problem of waste management, when viewed through the larger umbrella of knowledge, can help implement changes that lead us toward a more sustainable future, rather than continuing down an unsustainable path.

Designing to Discard

One might debate whether waste, as a complex system, should be classified as a wicked problem. Perhaps not, if we look at the early stages of the shift from frugality to consumerism, when the rise in the volume of waste generation was still relatively negligible. While consumer patterns were clearly on the rise, there was still a strong sense of value placed on the products owned, which were often used for a long time. However, the real turning point in this shift can be attributed to the concept of obsolescence — the deliberate strategy that encourages consumers to discard old products in favor of newer, more refined models.

Planned Obsolescence is a design strategy where products are intentionally made with a limited lifespan, prompting consumers to replace them more frequently. This often involves designing electronics with non-replaceable batteries or appli-

ances using materials that degrade quickly. While this approach boosts short-term sales, it results in vast amounts of waste, as products are discarded at an accelerated rate. Planned obsolescence directly contradicts sustainable design principles and exacerbates the waste hierarchy by speeding up the flow of waste materials.

Perceived Obsolescence, on the other hand, encourages consumers to discard perfectly functional items simply because they are no longer seen as trendy or current. Industries like fashion, technology, and consumer goods often leverage this tactic through constant style changes and advertising that convinces consumers that “newer” is inherently better. This strategy targets waste on a psychological level, persuading people to abandon products that still serve their purpose, solely based on aesthetics or social pressure.

System Trap: Shifting the Burden

The shifting the burden trap occurs when a system relies on quick, short-term solutions to address problems, rather than addressing underlying, more complex issues. In the case of planned and perceived obsolescence, companies create products designed to fail or become outdated quickly, encouraging frequent replacement rather than innovation for long-lasting, sustainable products. This short-term approach diverts attention from more meaningful changes, like designing for durability or repairability, which would reduce waste and conserve resources in the long run.



3. Towards a New Economy

As discussed in the previous chapter, design thinking is a vital strategy for addressing wicked problems by considering all design domains and balancing consumer needs, materiality, services, and aesthetics. However, when applied incorrectly, design thinking can drive unsustainable consumption, as seen in the case of deliberate obsolescence. Rather than focusing on waste reduction, these methods promote disposal and replacement as desirable actions, which only exacerbate the waste crisis. The result is a complex ripple effect that harms ecosystems, communities, and depletes natural resources.

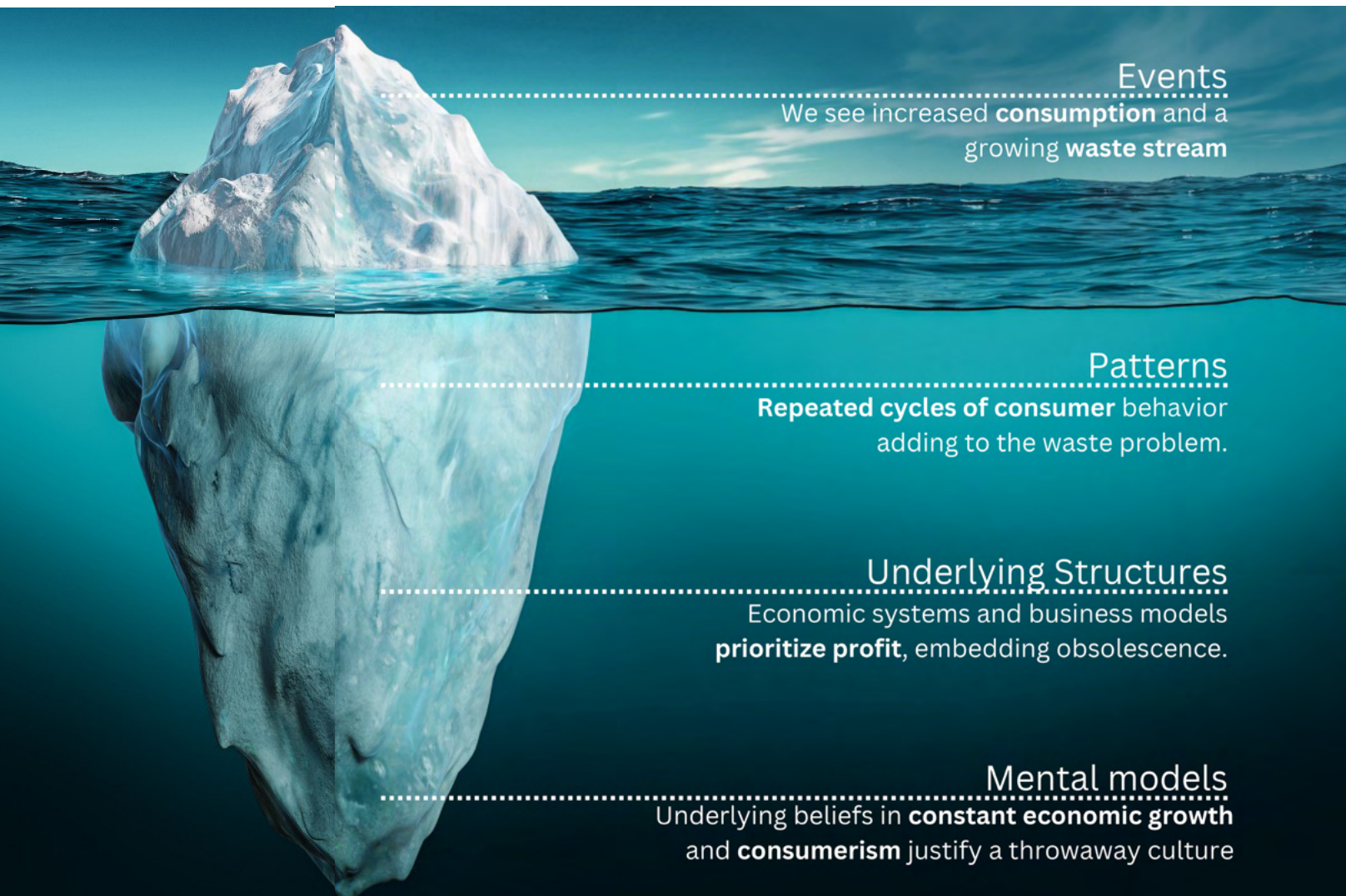
A prime example of this is the early light bulbs, which were designed to last longer but eventually became a threat to the industry's financial growth. To counter this, manufacturers introduced bulbs with a limited lifespan, reducing quality and increasing waste by encouraging consumers to replace them more frequently. Today, in the age of electronics, rapid software updates have made devices seem obsolete within just a year or two, reinforcing this culture of constant replacement.

This cycle of designing for disposability—where products are intentionally made difficult to repair—perpetuates excessive consumption and accelerates the extraction of natural resources. This approach not only harms the environment but actively contributes to the destruction of our planet. To address these issues, design thinking must evolve to prioritize longevity, reparability, and reuse, shifting the focus from endless growth to sustainable, responsible practices.

Beneath the Surface

The Hidden Forces of Obsolescence

Have you ever wondered why planned and perceived obsolescence became such a huge success? It can largely be attributed to the iceberg model of ideation. This metaphor explains how, as a society of consumers, we focused primarily on trends and fashion—the visible tip of the iceberg, floating above the surface. However, the true underlying cause, the massive submerged part of the iceberg, lies in the design strategy behind planned and perceived obsolescence. This hidden force is what drives behavior change, yet it remains out of sight unless we dig deeper to understand the systemic patterns at play.

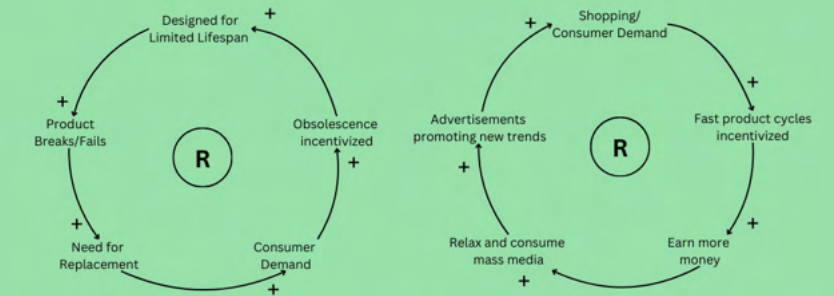


At the deepest level, mental models reflect societal beliefs and values that drive obsolescence. The belief in exponential economic growth and consumerism justifies planned obsolescence, promoting the idea that products are disposable and that convenience or newness is preferable to sustainability. This mindset also fuels perceived obsolescence, encouraging a consumer culture where owning the latest products is linked to status and self-worth.

On the next level, economic systems and business structures prioritize profit over sustainability. Planned obsolescence is embedded in production strategies, with products intentionally designed to have short lifespans. Perceived obsolescence, on the other hand, is driven by marketing and design trends that make older products feel outdated or undesirable. Both strategies support linear economic systems that emphasize continuous consumption and disposal over repair and reuse, reinforcing the cycle of waste.

Reinforce Loop Diagram:

Obsolescences are reinforcing feedback loops, where the cycle of consumption and disposal grows stronger. As companies continue to produce short-lived products, consumers expect new models, further encouraging disposable culture. The result is a growing environmental burden, as resources are depleted, and waste increases, while sustainable practices like product longevity or repairability are overlooked.



This reinforcing loop generates patterns over time, fueled by the rapid increase in consumer behavior, alongside the degradation of product quality, shorter lifecycles, and the heavy use of toxins. These strategies significantly contribute to the waste stream by driving more production cycles and encouraging more consumption.

The patterns they create are visible above the waterline, leading to more than just increased consumption. The effects extend to the pressure on resource demand and the subsequent environmental consequences: a rising demand for natural resources on one hand, and growing mountains of landfill waste, polluted oceans, and harmful emissions from incinerators on the other.

Beyond the Expansion Model

Design in the Age of Sustainability

The impact we are having on our planet is devastating, prompting the need for a shift in our mindset—one that limits our greed and growth. Earth is home to countless species, and it is as much their home as it is ours. We are taking more than our fair share at an accelerating rate, and this overconsumption is pushing the planet's capacity to heal beyond its limits. We need to reconnect with our role and understand where we truly fit within the web of life on this planet.

System Trap: Seeking the Wrong Goal

GDP has long been the standard metric for gauging a nation's success, representing the total economic output within a country. But by focusing only on economic activity, GDP overlooks broader dimensions of well-being, like environmental health, social equity, and happiness. This focus traps societies into the system of "seeking the wrong goal," where governments and industries prioritize short-term financial gains without fully addressing issues like ecological degradation, inequality, and social cohesion. For example, increased industrial activity that boosts GDP might lead to pollution, harming the environment and public health without considering the long-term consequences on quality of life.

Leverage Point: Goals

Shifting the goal is a crucial leverage point here: by redefining success beyond GDP to include holistic measures such as Gross National Happiness (GNH) or the Genuine Progress Indicator (GPI), societies can aim for sustainable development and greater well-being. Adopting these metrics would refocus the system toward valuing environmental health, social welfare, and equitable growth. Through this shift, policies and practices could emerge that align economic activity with sustainable and meaningful progress, guiding societies toward a more balanced and resilient future.

In this context, Victor Margolin's *Design for a Sustainable World* offers a critical examination of the role design plays in shaping our future. He contrasts two models of development: the expansion model and the sustainable model.

The expansion model, dominant since the Industrial Revolution, is driven by continuous economic growth, rising consumption, and the exploitation of natural resources. Margolin argues that this model is unsustainable, leading to severe environmental degradation and increasing social inequality. In contrast, the sustainable model seeks to maintain ecological balance while meeting human needs. It prioritizes conservation, renewable resources, and the equitable distribution of goods and services. This model challenges designers to rethink their roles, urging them to consider the long-term impacts of their work on both people and the planet.

Margolin explores how these two models shape design practice and education. He argues that most design still operates within the expansion model, focusing on creating products for market consumption without fully considering their environmental and social impacts. He views the shift from the expansion model to the sustainable model not only as a practical necessity but as a moral imperative. This shift would require redesigning not just individual products, but entire systems of production, distribution, and consumption. Designers would need to collaborate across disciplines and engage with complex social and environmental challenges.

Economic Boundaries

Rethinking Prosperity in a Finite World

In advocating for a shift from the expansion model to the sustainable model, Margolin stresses the need for new metrics of success, ones that transcend economic growth and market share. Kate Raworth, an economist, builds on this idea by proposing an innovative economic framework that redefines development in terms of social needs and planetary boundaries.

Her journey began with questioning the purpose of the economy, which traditionally centers on GDP as the ultimate measure of success. Raworth critiques GDP as a "cuckoo" that has successfully hijacked the nest of social well-being, with little awareness of its shortcomings. She argues that, given the finite nature of our planet's resources, the current growth-centric model risks leading us to societal collapse, as warned in *Limits to Growth*.

To realign the economy with these limits, Raworth introduces the concept of the "doughnut," a visual framework that represents a balanced, sustainable economy where human prosperity is achieved within the safe and just space between social needs and environmental boundaries.

The doughnut consists of two concentric rings. The inner ring represents the social foundation, below which lie critical human deprivations such as hunger and illiteracy. The outer ring represents the ecological ceiling, beyond which lie critical planetary boundaries like climate change and biodiversity loss. Between these two rings is the safe and just space for humanity—the "doughnut", where human needs can be met without exceeding the Earth's ecological limits.



Raworth, K. *Doughnut Economics*, 2017

Raworth argues that the goal of economic activity should be to bring humanity into this safe and just space. She critiques the mainstream economic focus on GDP growth, highlighting it as an outdated and dangerous fixation in the face of urgent social and environmental challenges.

Doughnut Economics presents a compelling vision for a more sustainable and equitable global economy, urging policymakers, businesses, and individuals to rethink economic goals and practices. It offers a hopeful, practical approach to addressing the complex issues of our time while prioritizing both social and environmental well-being.



4. Growth to Development

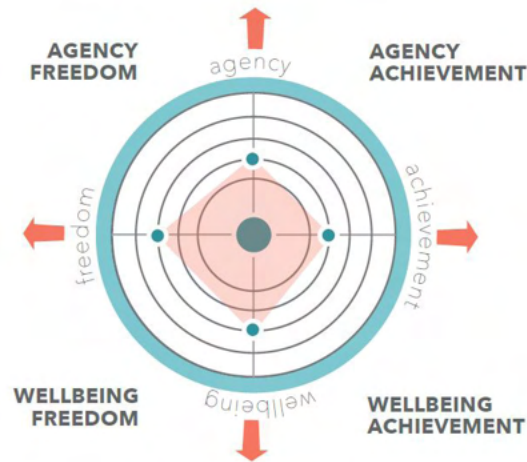
The path to a sustainable future is not defined by relentless growth but by a commitment to development that prioritizes quality of life, environmental well-being, and social equity. Rather than focusing on increasing GDP or production levels, which do not necessarily correlate with an improved standard of living or environmental health, the focus should shift to qualitative progress. Development is about becoming better, not just bigger. It requires a balanced and holistic approach that integrates social, economic, and environmental considerations, measuring progress through indicators like health, literacy, and ecological quality rather than consumption or output.

The first step towards this development is refining the way we measure and visualize human well-being. A new approach is necessary—one that evaluates the true capabilities of individuals and communities, while also providing opportunities for growth and closing the widening gap of social inequality. Change cannot be imposed blindly; the approach must be sensitive to how people understand and adapt to change, ensuring that development is inclusive and sustainable for all.

The Story of Human Potential

The Capabilities Approach

“Capability is an aspect of freedom concentrating on substantive opportunities.” — Amartya Sen



Boylston S. Adopted from Sen A.

Imagine a society where every individual has the freedom to live the life they truly value. This vision was the driving force behind the work of Amartya Sen and Martha Nussbaum, who sought to redefine how we measure human well-being. They recognized that traditional metrics like income or resource consumption fall short in capturing the true quality of people’s lives. What really matters, they argued, is not just what people possess, but what they can do with it — the opportunities they have to shape their lives in meaningful ways.

At the core of their approach are two key concepts: functionings and capabilities. Capabilities refer to the real freedoms or opportunities individuals have to achieve certain outcomes, to live lives they have reason to value. Functionings, in contrast, are the actual achievements or states of being people attain through these capabilities. These might include things like education, good health, or the ability to form social connections, all of which contribute to a richer, more fulfilling life.

Traditional welfare economics was confronted with a new perspective that prioritized ends over means, freedom over mere achievement, and recognized the rich diversity of human needs and contexts. The capabilities approach did more than remain a theoretical framework; it translated into practical action, reshaping how we measure human development and influencing social policies worldwide. As John Rawls put it, policies should aim to ensure the “greatest basic liberty without restricting the liberty of others.” This philosophy advocates for providing the greatest benefits to the most disadvantaged members of society while ensuring that no one is limited in their ability to work, grow, or thrive based on their identity.

The concept of liberty expands into two categories: positive liberty, which grants the freedom to act according to one’s own will, and negative liberty, which ensures freedom from external constraints or preventions, ultimately supporting equality of opportunity. Sen’s four concepts of advantages distinguish between freedom and achievement, viewing freedom as the means to achieve one’s goals. Alongside this, he contrasts wellbeing with agency—where agency refers to an individual’s capacity to act and effect change.

These four principles, when considered together, offer designers a framework for understanding how to intervene effectively in systems. They provide a way to visualize change, compare outcomes, and use a common lens to identify opportunities for improvement.

Martha Nussbaum’s TEN CENTRAL CAPABILITIES

LIFE	Not dying before one’s life is so reduced as to be not worth living.
BODILY HEALTH	To be adequately nourished and sheltered.
BODILY INTEGRITY	To be secure against violent assault.
SENSES, IMAGINATION + THOUGHT	To think and feel in a way that’s informed and cultivated by an adequate education.
EMOTIONS	To have attachments to things and people. Not having one’s emotional development blighted by fear.
PRACTICAL REASON	To form a conception of the good and to engage in critical reflection about the planning of one’s life.
AFFILIATION	To recognize and show concern for others. To engage in various forms of social interaction. To be treated as a dignified being whose worth is equal to others.
OTHER SPECIES	To live with concern for and in relation to animals, plants, and the world of nature.
PLAY	To laugh, to play, to enjoy recreational activities.
CONTROL OVER ONE’S ENVIRONMENT	Political: To participate effectively in political choices. Material: To hold property, and have the right to seek employment on an equal basis with others. To work as a human, exercising practical reason.

Boylston S. Adopted from Nussbaum M.

Martha Nussbaum developed a list of ten central capabilities, framing them as the key elements for achieving well-being. These capabilities include the ability to live a normal lifespan, maintain bodily health and integrity, and engage in critical thinking and education. Nussbaum underscores the importance of emotional connections, social interactions, and practical reasoning in shaping one’s conception of a good life. She also emphasizes the need for environmental concern, opportunities for recreation, and control over political and material circumstances. Central to her approach is the idea of human dignity—the fundamental freedoms necessary for individuals to flourish.

Envisioning the Future

Collaborative Design for Sustainable Societies

The increase in capabilities and opportunities doesn't eliminate the differences in opinions, goals, and priorities that exist among individuals living side by side. To address these diverse perspectives amongst participants, which we refer to as stakeholders, there is a clear need for collaboration. Terry Irwin, a design professor and director at the Transition Design School at Carnegie Mellon University, introduces the emerging Transition Design approach, which is specifically crafted to tackle wicked problems and catalyze societal shifts towards sustainable futures.

Transition Design offers a robust framework for addressing the complex challenges of today, such as climate change and social inequality. At its heart, this approach recognizes that these issues are too multifaceted for any single entity or discipline to solve alone. What sets Transition Design apart is its focus on uniting diverse voices—from community members to policymakers, business leaders to environmental activists, to create inclusive, collaborative solutions.

By creating a space for meaningful dialogue among diverse stakeholders, Transition Design transforms potential conflicts into opportunities for innovation. Take, for example, a city struggling with sustainable transportation. A Transition Design approach would bring together urban planners, environmentalists, business owners, and residents. At first, their views

may seem at odds—the business owner concerned about parking, the environmentalist advocating for bike lanes, and the resident focused on commute times. However, through facilitated discussions and collaborative visioning, these differing opinions can evolve into the foundation of a comprehensive, multifaceted solution.

Designers play a vital role in this process—not as sole problem-solvers, but as facilitators and synthesizers. Using design thinking methodologies, they help stakeholders visualize possible futures, prototype solutions, and refine ideas through iteration. This collaborative approach ensures the final outcomes are not only innovative but also aligned with the needs and values of the community. Additionally, Transition Design recognizes that societal change is a long-term endeavor. It encourages stakeholders to look beyond immediate fixes and consider how their actions today might shape the future for decades to come.

By framing differences of opinion as a source of strength rather than conflict, Transition Design creates a powerful platform for co-creation and collective problem-solving. It recognizes that the path to meaningful societal change doesn't lie in finding a single "right" answer, but in weaving together the diverse wisdom, experiences, and aspirations of all stakeholders. This collaborative process allows for the creation of solutions that are not only more comprehensive and resilient but also sustainable in the long term.



Flourishing Business adapted from The Natural Step

The Natural Step & Backcasting Model

The Natural Step is a global sustainability framework that helps organizations and communities design strategies for sustainable futures. Central to its methodology is the concept of backcasting—a strategic planning process that starts with defining a desirable future and then works backward to identify the steps necessary to achieve that future.

Unlike traditional forecasting, which predicts future trends based on current trajectories, backcasting challenges existing assumptions and focuses on what needs to be done to reach an ideal vision. The Natural Step's four system conditions for sustainability outline essential principles for protecting the environment and society. First, limit the extraction of resources from the Earth's crust to prevent depletion. Second, reduce the creation and accumulation of harmful synthetic substances in nature. Third, preserve ecosystems and biodiversity by avoiding actions that degrade natural systems. Finally, prioritize social equity by ensuring all people have their basic needs met within the planet's ecological limits.

The goal of backcasting is to move towards sustainability by envisioning a future in which these conditions are met, then identifying strategies and actions that can be implemented today to make that future a reality.

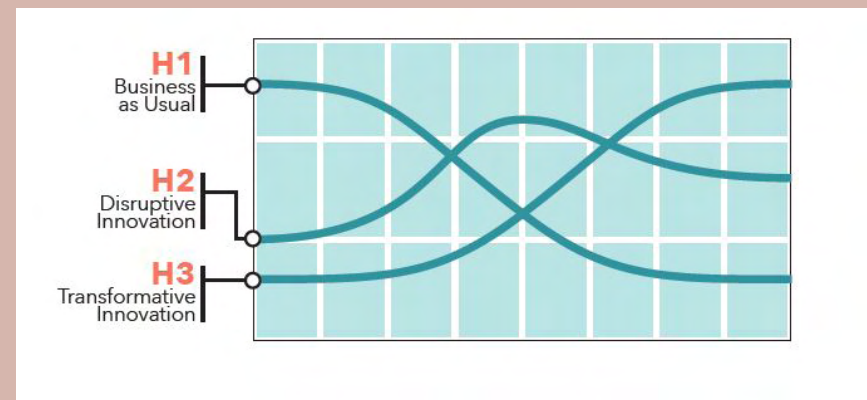
Transition Design emphasizes the importance of future visioning—looking beyond immediate challenges to envision the kind of world we want to build over the coming decades. By engaging diverse voices and perspectives, it fosters a collective vision for a sustainable future, ensuring that the solutions we develop today are deeply rooted in the needs, values, and realities of the communities they serve. In our interconnected world, Transition Design reminds us that the most effective solutions are those we create together, with an eye on the long-term, transformational change that addresses the systemic causes of today's problems.

Pioneering Profit with Purpose

The Green Giants

Transition Design helps us navigate complex systems with emphasis from growth metrics to development that prioritizes human well-being, but lasting impact also depends on a shift in business practices. Social movements are driving meaningful changes in consumer behavior; however, for individuals to live sustainably, businesses must step up, offering sustainable products, services, and systems that support these greener lifestyles.

An inspiring example is the “Green Giants,” a group of companies that have embedded sustainability into their core business while achieving billion-dollar profits. E. Freya Williams, in *Green Giants: How Smart Companies Turn Sustainability into Billion-Dollar Businesses*, highlights nine companies that prove sustainability and profitability can thrive together, challenging the misbelief that these goals are incompatible.



Bolyston S.

The Three Horizons Framework

The Three Horizons Framework is a strategic tool used to envision and plan for future change. It divides time into three stages: Horizon 1 represents the current system, focusing on optimizing existing practices, such as businesses adopting immediate sustainable actions. Horizon 2 involves innovations and transitions that disrupt the status quo, including new business models or technologies that challenge traditional approaches. Horizon 3 looks further ahead, imagining transformative, long-term shifts that could redefine systems and create sustainable futures.

This framework encourages businesses and organizations to balance short-term improvements with long-term visionary goals. By considering all three horizons, companies can anticipate emerging trends, adapt to change, and align their strategies to drive innovation while ensuring sustainability. It helps map a path from current practices to transformative futures, fostering a holistic approach to navigating complex societal challenges.

Leverage Point: Self-Organization

Self-organization refers to the power within a system to adapt, evolve, and even create new structures autonomously. In the context of sustainability, Green Giants—companies that incorporate environmental and social good into their business models—embody self-organization by rethinking traditional practices and creating innovative, sustainable strategies that align profit with purpose.

For example, companies like Tesla, Unilever, or Patagonia have disrupted conventional practices by embedding sustainable values deeply within their core operations, not just as an afterthought. These Green Giants have self-organized by fostering internal cultures that prioritize sustainability, adopting unique business practices, and encouraging all employees to align with these sustainable goals. Their efforts often spark industry-wide changes, influencing others to adopt similar sustainable models, thereby amplifying the impact of self-organized, sustainable initiatives.

Williams identifies six crucial factors that contribute to the success of these sustainable businesses

Iconoclastic Leadership: These companies are led by visionaries with strong convictions and a rebellious streak, who are willing to challenge industry norms.

Disruptive Innovation: Green Giants use sustainability as a catalyst for developing revolutionary products, services, or business models that disrupt their respective industries.

A Higher Purpose: These companies have a mission that goes beyond profit-making, which resonates with both customers and employees.

Built In, Not Bolted On: Sustainability is integrated into the core business strategy rather than being an afterthought or add-on.

Mainstream Appeal: Green Giants create products and services that attract a broad customer base, not just niche eco-conscious consumers.

New Behavioral Contract: These companies establish new norms and expectations in their industries, often changing how consumers interact with their products or services.

The Green Giants collectively generate over \$100 billion annually from their sustainable business initiatives—an amount that surpasses the GDP of 70% of the world’s 180 economies. Notably, many of these companies outperform their competitors in the stock market, proving that sustainability can enhance shareholder value.

These businesses show that substantial financial success can go hand-in-hand with positive societal and environmental impact. Their approach involves rethinking traditional business models, embedding sustainability into the core of their operations, and offering innovative, purpose-driven products and services that resonate with a wide consumer base. They underscore the importance of prioritizing sustainability as essential for both future resilience and modern growth.



5. Regulating Change

It has become increasingly clear that our current trajectory of growth is unsustainable. Irregular waste management practices, alongside harmful disposal patterns, continue to degrade our natural resources and threaten the delicate balance of the planet—our only means of survival.

While we've explored the potential for behavior change through frameworks like the capabilities approach and transition design, as well as the role of Green Giants in driving sustainable production, one critical aspect of this narrative remains under examined: the influence of power holders and decision-makers—the policymakers who regulate and guide the path forward.

In this chapter, we shift our focus to the vital role of policy, regulation, and certification in supporting sustainable practices and accelerating the transition towards a circular economy. As environmental challenges intensify, international organizations and global agreements have increasingly taken the lead, offering both strategic guidance and ambitious goals for global sustainability. These efforts are not only pivotal in shaping global discourse but also serve as the foundation for national and local policies.

When these policies are effectively enacted, they drive systemic change across industries, creating an environment where sustainability can thrive. Thus, regulations and frameworks that incentivize and enforce responsible practices are essential for steering us toward a more sustainable and equitable future.

Sounding the Alarm

The Intergovernmental Panel on Climate Change

The Intergovernmental Panel on Climate Change (IPCC) is a crucial organization in the global fight against climate change. It was established in 1988 by the World Meteorological Organization (WMO) and the United Nations Environment Programme (UNEP) to provide scientific assessments of climate change. As the leading authority on climate science, the IPCC plays a vital role in connecting scientific research with policymaking. Instead of conducting its own original research, the IPCC compiles and assesses existing scientific literature from around the world. It brings together the expertise of thousands of scientists and experts, synthesizing their findings to guide policymakers.

The IPCC is divided into three Working Groups, each focusing on different aspects of climate change. The first group focuses on the physical science behind climate change, studying the science of how the climate is changing. The other two groups assess the impacts of climate change, adaptation strategies, and vulnerabilities, while also exploring ways to reduce greenhouse gas emissions through mitigation.

Every five to seven years, the IPCC publishes comprehensive Assessment Reports that give a clear and objective summary of climate science, its impacts, and possible solutions. The most recent report,

released in 2023 as part of the Sixth Assessment Report cycle, emphasizes the urgent need for immediate action to address climate change.

In addition to its regular Assessment Reports, the IPCC also publishes Special Reports on specific topics. One notable example is the 2018 report on Global Warming of 1.5°C, which had a significant impact on global climate discussions. The IPCC follows a thorough review process, with multiple rounds of surveys from experts and governments, which ensures that its findings are transparent and credible. While the IPCC provides essential information to help guide policymakers, it remains neutral and does not promote specific policies or actions.

As climate change accelerates, the IPCC's role is becoming more crucial. Its findings show that changes are happening faster than ever, with some impacts already irreversible. However, the IPCC also provides potential pathways for limiting global warming and adapting to the changes that are already underway. By highlighting both the challenges and possible solutions, the IPCC empowers decision-makers and the public to take informed action. Its ongoing work is key in shaping our global response to climate change, offering both a sense of urgency and hope for a sustainable future.

The Blueprint for Sustainable Development

Agenda 21

Agenda 21 is a landmark blueprint for global sustainable development, created during the 1992 Earth Summit in Rio de Janeiro. This action plan marks a major step in international cooperation, aiming to balance human progress with environmental protection.

At its heart, Agenda 21 is a non-binding agreement that sets a vision for sustainable development in the 21st century. It acknowledges that environmental challenges are closely tied to economic and social issues, emphasizing the need for a holistic approach to address global problems. To encourage consumption and production patterns that lessen environmental impact and meet humanity's basic needs.

One of the most innovative aspects of Agenda 21 is its focus on local action. The plan encourages governments at all levels—from national to municipal—to create their own 'Local Agenda 21' strategies. This approach recognizes that while global issues need international cooperation, real change often begins at the grassroots level.

Agenda 21 calls for shifts in consumption, especially in developed countries, to ease the strain on global resources. It emphasizes integrating environmental considerations into economic decisions, promoting the idea that true progress requires balancing economic growth with ecological sustainability.

Agenda 21 emphasizes the need to eliminate poverty, recognizing that economic inequality often leads to environmental harm and unsustainable resource use. It outlines specific strategies to address critical issues, including protecting the atmosphere, managing land resources, combating deforestation, and preserving biodiversity. The plan stresses that resource management should be approached in a connected way, as challenges like water scarcity, soil degradation, and ecosystem loss are all interlinked.

Addressing these problems requires solutions that consider their impacts together as a holistic approach, addressing the interconnectedness of climate issues. Society needs to reduce waste generation and develop effective disposal of waste products and materials.

Leverage Point: Rules

"Rules" refer to the regulations, policies, and incentives that shape how a system operates and guide individual behavior within it. Rules act as boundaries that control the flow of actions and decisions; changing a system's rules can significantly alter outcomes and even its structure. For example, regulations like carbon taxes or waste disposal bans can shift corporate and consumer behavior toward more sustainable practices by penalizing unsustainable actions and rewarding eco-friendly ones. Rules have the power to either enable or restrict certain actions, making them essential leverage points in shifting a system's direction.

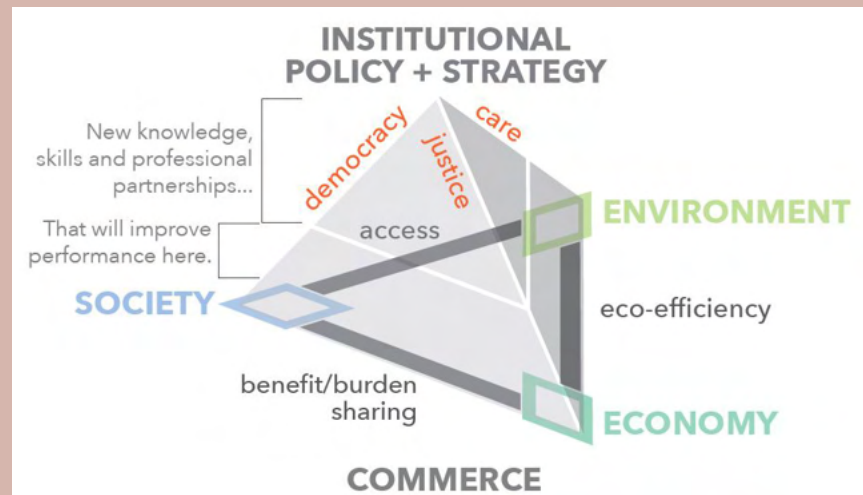
Validating Sustainability Claims

Certifications

Agenda 21 has played a major role in shaping environmental policies around the world, inspiring countless initiatives and guiding sustainable development efforts for decades. Its influence lives on in later UN efforts, such as the Millennium Development Goals and the more recent Sustainable Development Goals, which we'll explore at the end of this chapter. Achieving sustainable development isn't something any one nation can do alone—it requires cooperation

across the globe.

The vision set out by Agenda 21 continues to inspire both action and debate, reminding us of our shared responsibility to protect the planet for future generations. It encourages new ideas of wealth and prosperity that rely less on the Earth's limited resources and focus more on working within the planet's natural limits.



Bolyston S. adapted from Bonniot and Spangenberg

Institutional policy and strategy are integral to shaping sustainable development. They refer to the framework of rules, regulations, and guidelines adopted by governments, organizations, and institutions to drive long-term sustainability. These policies aim to address environmental, social, and economic challenges by setting clear objectives and priorities that align with sustainability goals.

Strategies ensure that these policies are effectively implemented and adapted over time, guiding institutions to integrate sustainability into their operations, governance, and decision-making processes. This approach fosters a coherent, organized response to global challenges, promoting widespread societal transitions toward more sustainable practices.

Leverage Point: Information Flows

Certifications like Cradle to Cradle, GRI, SASB, and ISO standards serve as leverage points by enhancing information flows. They set clear benchmarks that allow companies to communicate their sustainability efforts transparently, making critical data available for stakeholders to hold businesses accountable. This alignment fosters an environment where sustainable practices are encouraged across supply chains and industries.

As more companies adopt these certifications, they establish industry-wide norms that support responsible practices. These standards empower consumers and investors with the information they need to make informed choices, gradually shifting the system toward greater transparency and sustainability.

Building on international efforts, it's important to look at how third-party certifications help promote sustainable practices and the circular economy. These certifications set clear standards for businesses and organizations, making their sustainability efforts more trustworthy and transparent. They play a key role in verifying a company's environmental and social impact. Not only do they help guide businesses, but they also allow consumers and stakeholders to make better choices.

By adopting these certifications, businesses can show their commitment to sustainability, build credibility, and offer stakeholders clear metrics for evaluating their environmental and social performance.

These third-party validations are key tools in shifting towards more sustainable and circular business models, working alongside the broader policy frameworks and global initiatives mentioned earlier. As we explore the importance of policies, regulations, and certifications, it's clear that they form a crucial link in the push for sustainable practices and a circular economy. They provide the structure, guidance, and validation needed to reshape how we manage waste, use resources, and care for the environment.

Cradle to Cradle Certification

The Cradle to Cradle Certified Product Standard assesses products based on five sustainability areas: material health, material reuse, renewable energy and carbon management, water stewardship, and social fairness. This certification supports circular economy principles by encouraging the design of products that are safe, circular, and produced responsibly.

Global Reporting Initiative (GRI)

While GRI is mainly known for its sustainability reporting standards, it also offers a professional certification program. The GRI Sustainability Professional Certification validates expertise in sustainability reporting and the application of GRI Standards, enhancing the credibility of sustainability professionals and the reports they produce.

Sustainability Accounting Standards Board (SASB)

SASB provides industry-specific standards for identifying, managing, and reporting on financially material sustainability topics. While not a certification as such, SASB's framework is widely recognized and used by investors and companies to assess sustainability performance in a financially relevant context.

International Organization for Standardization (ISO)

ISO offers various standards related to environmental management and sustainability, such as ISO 59004 that provides guidance for sustainability implementations and ISO 59010 for actions required for Circular Business strategy. These standards provide organizations with frameworks to improve their environmental performance and social responsibility practices.

Global Development Goals

Millennium Development Goals



SUSTAINABLE DEVELOPMENT GOALS



Left: UNDP, 2012. Right: UNDP, 2015

As the world entered the new millennium, the global community saw the urgent need to address poverty and improve quality of life worldwide. This led to the creation of the Millennium Development Goals (MDGs) in 2000—a set of eight bold targets, primarily aimed at helping developing countries. The MDGs focused on critical areas: eliminating extreme poverty and hunger, ensuring universal primary education, promoting gender equality, reducing child mortality, improving maternal health, fighting major diseases, supporting environmental sustainability, and building global partnerships.

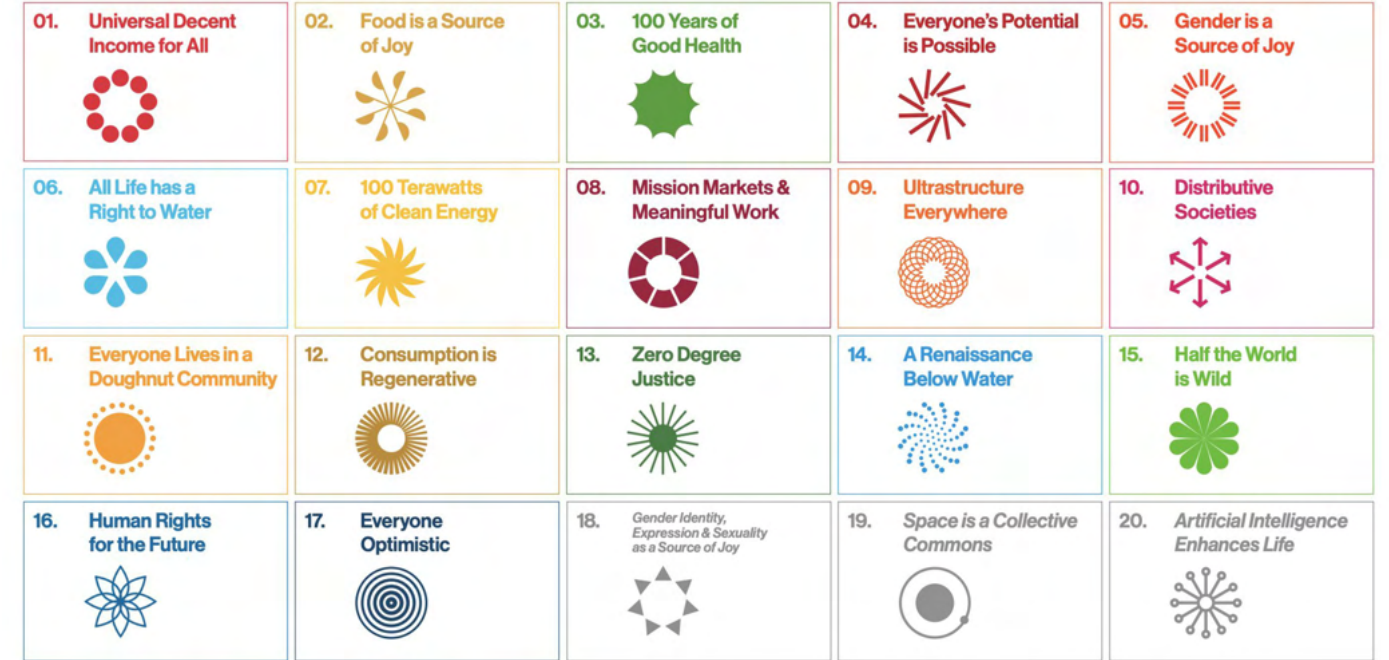
While the MDGs made progress in many areas, they also showed the interconnectedness of global challenges and the need for a broader approach. As the 2015 deadline approached, it became clear that sustainability and development are closely linked, and environmental issues cannot be separated from social and economic concerns.

This realization led to the creation of the Sustainable Development Goals (SDGs) in 2015. The SDGs marked a significant shift, expanding from eight goals to seventeen and, importantly, applying to all nations, not just developing ones. This universal approach recognized that sustainability challenges affect every country, though in different ways. The SDGs combined economic, social, and environmental aspects of sustainable development, acknowledging their interconnection and the need for comprehensive solutions.

The SDGs also gave greater focus to issues like climate change, sustainable consumption, and the need for peaceful, inclusive societies. They introduced the idea of “leaving no one behind”, emphasizing the importance of addressing inequality and supporting the most vulnerable populations.

Awesome Anthropocene Goals

FUTERRA



Futerra, 2022

As we move through the SDG era, visionaries and futurists have started to look beyond 2030, asking: What's next? This forward-thinking approach led to the creation of the Awesome Anthropocene Goals by Futerra. These goals offer a bold reimagining of the future, going beyond sustainability to envision a thriving, regenerative world by 2050. These new goals challenge us to imagine a future where we've not only solved today's problems but also created new systems that live in harmony with the planet. These goals include bold targets like universal decent income, regenerative consumption, and using artificial intelligence to enhance life.

This evolution from the MDGs to the SDGs and now to the Awesome

Anthropocene Goals reflects our growing understanding of global challenges and our expanding vision for the future. We've progressed from focusing on basic needs and poverty alleviation to adopting a more holistic view of sustainability, and now, to an aspirational vision of a thriving planet and humanity. Each step has broadened our perspective and deepened our commitment to a better world. The MDGs taught us the power of focused global action. The SDGs emphasized the importance of integration and universality. Now, the Awesome Anthropocene Goals are challenging us to dream bigger, imagining a future where humanity not only coexists with nature but actively regenerates and enhances our shared world.



6. Waste as resource

The journey towards a sustainable future requires us to fundamentally rethink our relationship with waste. As we've explored the principles, strategies, regulations, and policies aimed at reducing consumption and production patterns, we've laid the groundwork for minimizing waste generation and its environmental impact. However, the reality remains that we cannot entirely eliminate waste production. What we can do, though, is revolutionize our approach to waste management, shifting away from the destructive traditional disposal techniques of landfilling, ocean dumping, and incineration that have collectively wreaked havoc on our planet.

This paradigm shift begins with a simple yet profound change in perspective: viewing waste not as a burden to be disposed of, but as a valuable resource to be harnessed. This new lens aligns with the concept of a circular economy, where materials are kept in use for as long as possible, extracting maximum value before being recovered and regenerated at the end of their service life.

At the heart of this transformation lies the principle of the 4Rs: Reduce, Re-use, Recycle, and Recover. This hierarchy of sustainable practices guides us in prioritizing our efforts, emphasizing the importance of reduction and reuse before considering recycling and recovery. By adhering to this sequence, we can significantly diminish the volume of waste that requires management while conserving resources and energy.

Closing the Loop

Reimagining Industrial Systems

“Why wouldn’t our industrial system behave like an ecosystem, where the wastes of a species may be resource to another species? Why wouldn’t the outputs of one industry be the inputs of another, reducing use of raw materials, pollution, and saving on waste?”

— Robert Frosh & Nicholas Gallapoulos, 1989

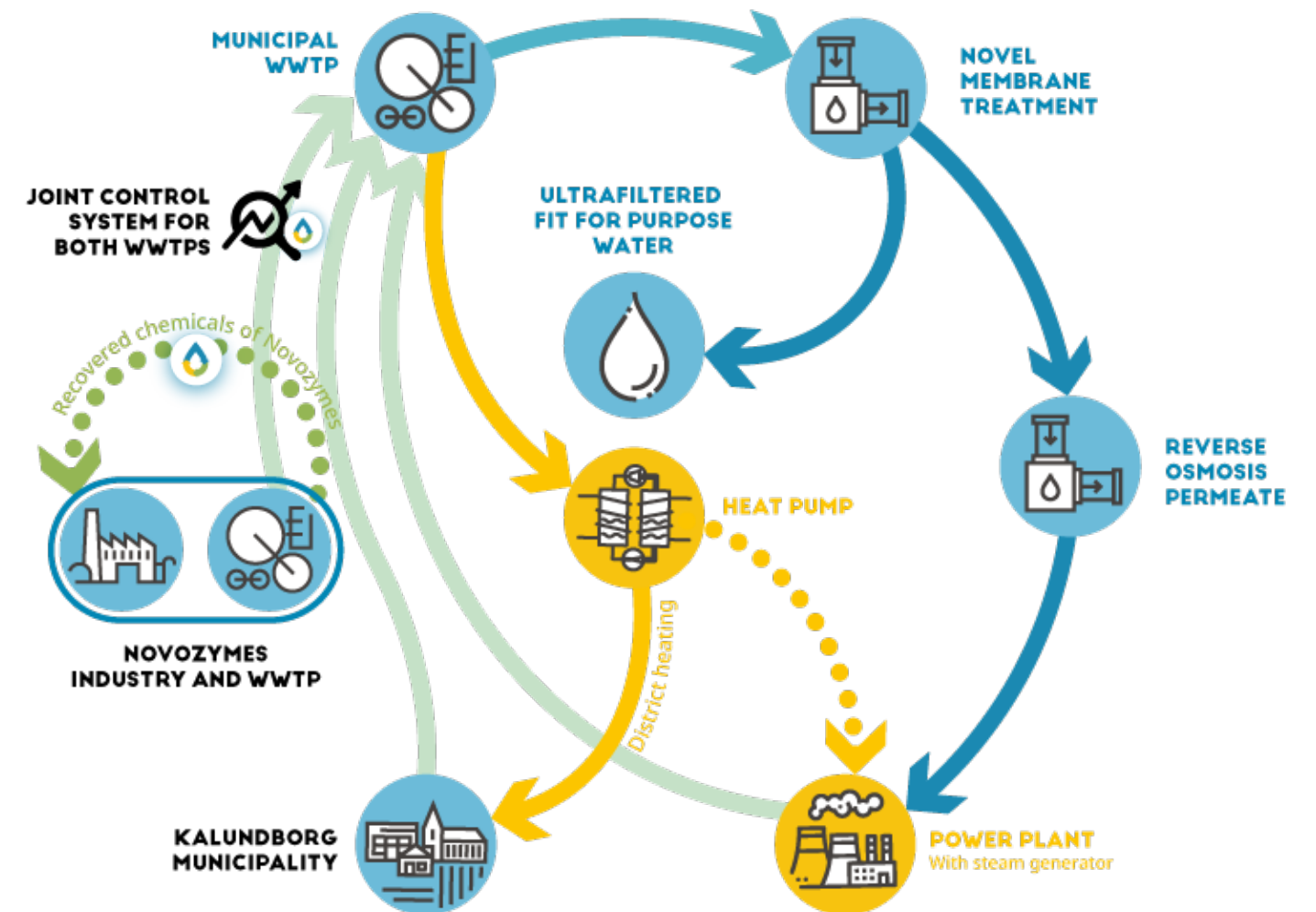
In the pursuit of sustainable development, we increasingly look to nature for ideas. One promising approach inspired by biomimicry is industrial ecology. This innovative field aims to transform industrial systems from wasteful, linear processes into efficient, circular ecosystems that mirror natural cycles. Industrial ecology is based on the idea that industrial systems should operate like ecosystems, where waste from one process serves as input for another. This holistic approach considers the flow of materials and energy throughout the lifecycle—from raw material extraction and product manufacturing to use, disposal, or recycling.

An inspiring example of industrial ecology in practice is the Kalundborg Symbiosis in Denmark. Established in 1972, this pioneering eco-industrial park has become a global model for sustainable industrial development. It began with a simple collaboration between a power plant and an oil refinery, where the power plant supplied excess steam to the refinery for its processes. This initial

partnership ignited a movement in resource sharing and waste reduction that has since expanded to involve multiple companies and the local municipality.

This complex network of resource sharing at Kalundborg has led to significant economic and environmental gains. Each year, the Kalundborg Symbiosis saves 24 million euros by reducing resource consumption and waste management costs, while also significantly reducing CO2 emissions and water usage.

Kalundborg’s success shows that industrial ecology is not just a theoretical idea but a practical, achievable model. By treating waste as a resource and encouraging collaboration between different industries, we can build more sustainable and efficient industrial systems. It highlights how, with creativity, cooperation, and inspiration from nature, we can transform industrial landscapes into thriving ecosystems that benefit both business and the environment.



Kalundborg Industrial Symbiosis, Ultimate water

As we confront the urgent issues of climate change and declining resources, the principles of industrial ecology offer a valuable way forward. By rethinking our industrial processes as interconnected ecosystems, we can lower our environmental impact, conserve resources, and create stronger, more sustainable economies. Moving ahead, the real challenge will be to expand these principles further, encouraging the kinds of partnerships needed to establish more eco-industrial parks and integrating industrial ecology into our economic and policy systems. This approach could help us reach a future where our industries not only minimize harm but also contribute positively to the health of our planet.

Designers as Alchemist

Transforming Waste into Wonder



The Greater Group adapted from Okala

In today's world of sustainable design, designers are moving into roles that go far beyond aesthetics and functionality. They're becoming like modern-day alchemists, changing how we think about materials, products, and waste. Acting as 'nutrient managers,' designers lead a movement to close the loop on resource use and redefine our connection to the objects around us.

Inspired by nature's cycles—where one organism's waste becomes another's food—designers are now creating products that, when they're no longer useful, can become resources for either biological or technical cycles. This approach shifts away from the old 'take-make-dispose' model toward a circular economy, where materials are continually reused and recycled.

In this new role, designers must think about a product's entire lifecycle—from raw material extraction to manufacturing, use, and, finally, disposal or reuse. To support designers with this complex challenge, tools like the Okala Ecodesign Strategy Wheel have been created. This framework takes a holistic view of sustainable design, offering strategies for each phase of a product's lifecycle.

The wheel has eight sections, covering key stages in the design process: Innovation, Materials, Manufacturing, Transportation, Use, End-of-Life, Product Systems, and Influence.

The Good City

Victor Margolin's "The Good City" envisions sustainable urban environments through innovative design approaches. This concept emphasizes the city as a crucial site for implementing sustainable practices, recognizing the potential for coherent policies and systemic change at the urban level.

Margolin introduces the idea of the "citizen designer," who operates across micro (individual), meso (group), and macro (governmental) levels. The city, positioned at the meso level, becomes a powerful arena for implementing sustainable design ideas and fostering community engagement.

The approach advocates for a holistic, systemic strategy to urban planning, addressing key factors such as food production and distribution, waste recycling, housing solutions, support for cooperative businesses, and alternative energy. Margolin emphasizes the importance of integrating diverse stakeholder perspectives and focusing on practical, implementable solutions to create more livable, sustainable urban communities.

By framing the city as a site for transformative change and highlighting the role of designers in facilitating this process, Margolin's concept offers a compelling vision for creating sustainable urban futures through collaborative, community-centered approaches.

Using the Okala Ecodesign Strategy Wheel, designers can tackle environmental impacts throughout a product's entire lifecycle. This approach to design requires a fundamental shift in thinking.

Designers must become systems thinkers, considering not just the immediate function of a product but its entire journey through the economy and environment. It also means working closely with experts in materials science, manufacturing, and waste management to create products that fit into a circular system.

The role of designers as nutrient managers is not without its challenges. It requires a deep understanding of materials science, chemistry, and ecology. It demands creativity in finding new uses for waste materials and in designing products that can

be easily disassembled and recycled. And it calls for a long-term perspective that considers the impact of design decisions decades into the future.

By designing products that nourish rather than deplete our planet, designers hold the potential to turn our material world from one of environmental harm into a force for regeneration. They can shape a future where waste is no longer a burden, but a valuable resource; where products support ecosystems rather than harm them; and where human creativity aligns with nature's cycles.

In this new way of thinking, every product offers the chance to give back to the planet, and every designer takes on the responsibility of caring for our shared environmental legacy.

Catalyzing Change

The Power of Community-Based Social Marketing

In our journey towards a sustainable future, we face a core challenge: how can we effectively motivate individuals and communities to adopt environmentally friendly behaviors? Traditional methods that rely on information campaigns, marketing and awareness have had limited impact. This is where Community-Based Social Marketing (CBSM) offers a new approach.

Developed by environmental psychologist Doug McKenzie-Mohr, CBSM shifts the focus in behavior change efforts. Unlike conventional methods, which assume that knowing about an issue leads to action, CBSM acknowledges that human behavior is shaped by many factors beyond information alone. CBSM centers on a systematic approach, drawing from psychology and social marketing to understand and address the specific barriers preventing sustainable behaviors. It's built on the idea that lasting change is most effective at the community level, where direct engagement and customized strategies can be applied.

Resistance to behavior change generally stems from three main reasons, focusing on two key factors: benefits and barriers. First, people might be unaware of the activity or its potential benefits. Second, they may know about it but perceive obstacles or challenges in adopting the new behavior.

Finally, even if they don't see barriers to the new behavior, they might feel their current habits provide greater benefits. All these factors highlight the importance of bridging the gap in thinking by offering greater benefits and eliminating all possible barriers to support effective behavior change. It's also essential to recognize that new behavior competes with established habits and must effectively replace them to succeed.

For sustainable change, new behaviors need to not only offer clear advantages but also become easier or more rewarding than the old ones.

The Earth Charter

The Earth Charter is a global declaration that articulates fundamental principles for building a just, sustainable, and peaceful world. Initiated by the United Nations in 1987 and finalized in 2000, it offers a comprehensive ethical framework that emphasizes respect for nature, universal human rights, economic justice, and a culture of peace. The Earth Charter aims to inspire and guide individuals, organizations, and governments toward actions that promote ecological sustainability, social equity, and shared responsibility.

Structured around four main pillars—respect and care for the community of life, ecological integrity, social and economic justice, and democracy and peace—the Earth Charter outlines essential guidelines for achieving a sustainable future. It serves as a foundational document that supports global movements for sustainability and encourages policies and actions that respect both human and ecological well-being.

What sets CBSM apart is its toolbox of behavior change techniques, grounded in social science research. Key tools include commitments, prompts, norms, and incentives.

Commitments help people envision themselves as sustainable actors, fostering a sense of responsibility.

Prompts are strategic reminders designed to encourage specific behaviors by appearing close in time and space to the target action. They are especially effective for reinforcing small, repetitive tasks and work best when they are visually engaging and self-explanatory, requiring no extra effort to understand.

Norms play a powerful role by showing examples of others practicing the behavior, which normalizes and encourages change.

Finally, incentives, whether small or substantial, acknowledge and reward sustainable actions, making new behaviors feel rewarding and reinforcing positive change.

When used thoughtfully, these CBSM tools have shown impressive results in a wide range of areas, from boosting recycling efforts to encouraging energy-saving practices. What makes CBSM particularly powerful is its flexibility and its understanding that real, lasting change grows from the community level.

By actively involving communities in the process, CBSM builds a sense of ownership and collective responsibility, inspiring people to take meaningful steps toward environmental control.



Conclusion

As we look towards a sustainable future, the Triple Bottom Line (TBL) approach offers a foundation that underscores the need to balance three essential pillars: people, planet, and prosperity. This framework insists that for businesses, communities, and nations to thrive in the long term, social equity, environmental health, and economic viability must be seen as interconnected. Each aspect of the TBL reinforces the others—ensuring environmental health supports human well-being, which in turn drives economic stability and opportunity.

The TBL reframes success, advocating for a shift from growth-centered metrics to measures that value and sustain both human and ecological health. By integrating these three elements, we create a pathway where business and societal progress no longer come at the expense of our planet but work in harmony with it.

This balance reminds us that, while we need prosperity, it should not compromise the planet's resources or the well-being of communities. For genuine sustainability, we must prioritize people, protect natural systems, and ensure economic resilience. The TBL serves as a lens through which sustainable practices can be viewed and achieved, inspiring actions that are regenerative, inclusive, and grounded in the larger purpose of societal well-being.



A Holistic Solution



Boylston S.

Achieving true sustainability requires a shift not only in our actions but in how we think, interact with the material world, and structure society. This approach uses “Mind,” “Matter,” and “Society” as powerful tools to balance the Triple Bottom Line.

Mind: Reshaping Collective Consciousness

The “Mind” framework highlights the role of perceptions, values, and habits in driving change. By rethinking our stories and values, we can foster a deeper connection with each other and the environment. This transformation includes recognizing diverse, often marginalized cultural perspectives, enabling new ways of imagining “what could be” rather than just “what is.” This mindset shift is crucial for cultivating innovation and lasting sustainable practices.

Matter: Transforming the Physical World

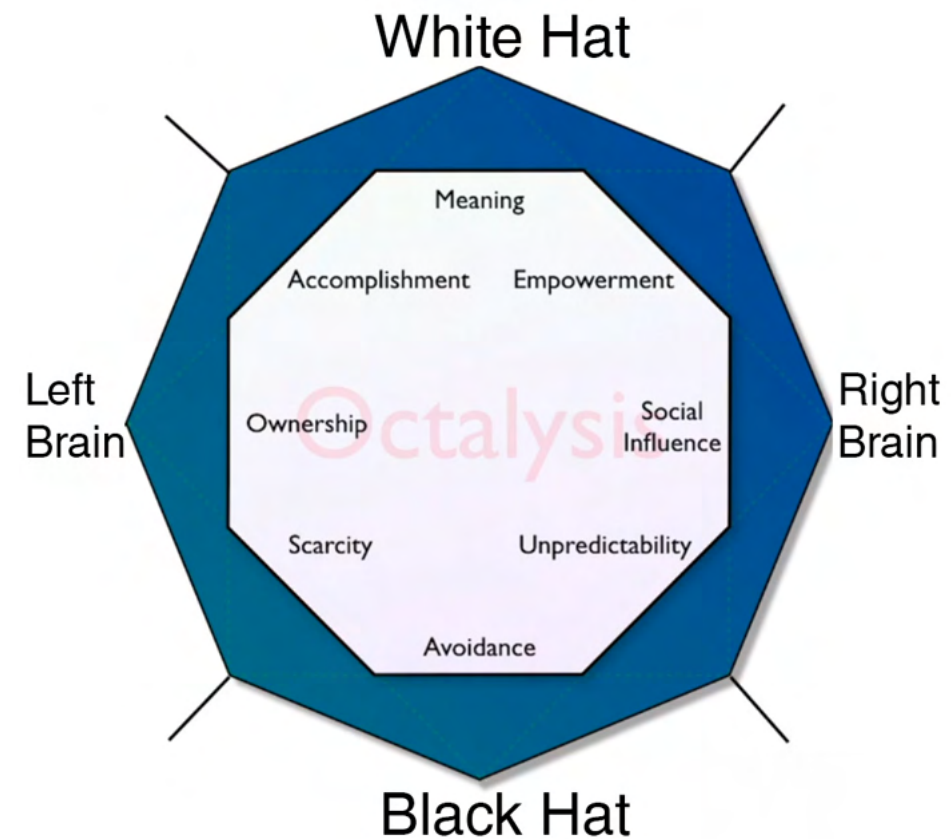
“Matter” focuses on the tangible side of sustainability, such as resource efficiency, circularity, and life cycle assessments. Embracing alternative materials, cradle-to-cradle design, and renewable energy can greatly reduce environmental impacts. Moving toward service-based rather than product-based models represents a critical shift, enhancing our relationship with the material world while reducing waste.

Society: Reimagining Collective Futures

The “Society” framework emphasizes equitable, inclusive solutions that unite individual actions with shared goals. It calls for addressing power imbalances, amplifying diverse voices, and supporting community assets to build resilience. This approach recognizes that sustainable development is an ongoing, iterative process, where learning and adaptation lead the way toward a fair, sustainable future for all.

Octalysis

A Framework for Human Motivation



Medium adapted from Chou J.

In our journey towards sustainability, understanding and leveraging human motivation is paramount. The Octalysis framework, developed by Yu-kai Chou, offers a comprehensive model for analyzing and optimizing human-centric design through eight core drives of motivation. These drives include:

- Epic Meaning & Calling:** Creating a sense of purpose and belonging.
- Development & Accomplishment:** Providing opportunities for growth and achievement.
- Empowerment of Creativity & Feedback:** Encouraging creativity and responsive feedback.
- Ownership & Possession:** Fostering a sense of ownership and control.
- Social Influence & Relatedness:** Leveraging social connections and community.
- Scarcity & Impatience:** Utilizing the power of scarcity and anticipation.
- Unpredictability & Curiosity:** Keeping engagement through surprise and curiosity.
- Loss & Avoidance:** Preventing negative outcomes to drive behavior.

By incorporating the Octalysis framework, we can better design systems and policies that motivate individuals and organizations to adopt sustainable practices. This approach ensures that the transition to sustainability is not only driven by necessity but also by genuine engagement and commitment.

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Have you ever wondered how much waste you generate in a single day? Or what happens to it once it leaves your hands?

Most of us have likely thought about waste at some point, but has it ever led to a shift in our behavior?

This book is an invitation to rethink waste, not as a guilt-laden topic, but as an opportunity to adopt a more sustainable approach to how we manage it.

It isn't about making you feel bad for the role we all play in contributing to environmental harm. Instead, it's about offering practical steps for change. It's about learning from what we've gone through and how we can move towards a more sustainable future.

We may one day succeed in finding water on Mars, or we may not. But for now, Earth is our only home. It has provided us with resources far beyond what we deserve—let's show it the care and respect it deserves. Let's give back to this wonderful planet that allows us to live, thrive, and grow.