



Systems Thinking as a Paradigm Shift for Transformational Sustainability

By

Ezeaku Emeka Cyril

The University of America

Curacao, Willemstad

Abstract:

This article explores the concept of systems thinking as a profound paradigm shift essential for achieving transformational sustainability. It delves into the fundamental principles of systems thinking, highlighting its potential to revolutionize our approach to addressing complex and interconnected sustainability challenges. The article begins by elucidating the core principles of systems thinking. It emphasizes the importance of viewing complex issues holistically, recognizing the interdependencies, feedback loops, and dynamic nature of systems. The study underscores the need for a transformational approach to sustainability. It argues that piecemeal solutions are insufficient in addressing the multifaceted and systemic challenges that global sustainability encompasses. Through real-world examples and case studies, the article illustrates how systems' thinking has been applied successfully in various domains, from environmental conservation to organizational management. The article highlights the role of collaborative decision-making processes in harnessing the power of systems thinking. It discusses how stakeholders from diverse backgrounds can work together to design and implement sustainable solutions. Acknowledging the challenges of embracing systems thinking, the study addresses potential barriers, including resistance to change, limited awareness, and the need for enhanced interdisciplinary collaboration. The article concludes by emphasizing the urgency of adopting systems thinking as a fundamental shift in our approach to sustainability. It calls for increased education and awareness, fostering a culture of systems thinking, and integrating it into policy and decision-making processes. In a world facing complex and interrelated sustainability challenges, systems thinking emerge as a paradigm shift that holds immense promise. This article advocates for the widespread adoption of systems thinking as a transformative tool to address the intricate and pressing sustainability issues of our time.

Keywords: Understanding systems thinking, Transformational sustainability, Systems thinking in practice: Collaborative decision-making, Challenges and barriers: The path forward:

1. Introduction

Sustainability challenges are very complicated (EEA, 2019) because they are caused by processes of rapid, dynamic change that link many different, nuanced concerns. This creates problems that have never been seen before and are fundamentally systemic (Ramos & Hynes,

2019). The 17 Sustainable Development Goals (SDGs), which were announced in 2015 as part of the UN 2030 Agenda, can help you understand what it means to be sustainable.

They encompass the idea of a sustainable society that is inclusive, takes into account social, environmental, and economic capital, and has the potential to garner public attention and sway public opinion (Hak et al., 2018). The SDGs cover the whole world, are connected, and can't be broken up. They also apply to everyone. They demand significant changes in every nation, but there isn't agreement on how to carry out the objectives (Sachs et al., 2019).

In this situation, our communities and economies must move from their current unsustainable state to a sustainable and resilient one (Fig. 1) through an integrative strategy that targets all 17 SDGs, building on their synergies and advantages while minimizing their trade-offs (IIASA, 2018).



Fig. 1. the transformational process for achieving the SDGs and transitioning to a sustainable world (adapted from IIASA, 2018).

Environmental policies around the world have changed from being narrow, sectoral, poorly coordinated, or even overlapping and conflicting to more integrated decision-making (Fiksel et al., 2009; Bone et al., 2011; Giakoumis and Voulvoulis, 2018a), with the idea of taking a systems approach to addressing sustainability challenges becoming more popular and gaining praise (Funke, 2010).

However, the environment is still getting worse (Yadvinder et al., 2020), and the chance for societies all over the world to avoid catastrophe is "rapidly closing" despite the fact that there have been a lot more environmental laws and agencies established globally over the past 40 years—a 38-fold increase since 1972. According to the first-ever global evaluation of environmental law (UNEP, 2019), one of the biggest problems with trying to stop climate change, reduce pollution, and keep species and habitats from going extinct is that these rules aren't being implemented and enforced well enough.

A few months ago, the UN's Intergovernmental Panel on Climate Change (IPCC) said that the world economy needed to be restructured quickly and on a scale that had "no documented historical parallel" (IPCC, 2018). Because sustainability issues are so complicated, it is impossible for governments to predict how all actors and stakeholders will react when they do act. Even simple regulatory actions often have unintended consequences.

For example, Severnini (2019) showed that in the United States, limiting the building of hydroelectric projects to protect ecosystems led to an increase in carbon dioxide emissions of about 1,400 tons per year for each megawatt of fossil fuel power generation capacity that replaced hydropower, which is a clean, renewable energy source.

As the issue of climate change became more important, the UK government gave people incentives to switch to diesel cars in 2001. Diesel automobiles emit less CO₂ than gasoline-powered vehicles, which is the foundation for these incentives. This caused nitrogen oxides and small particles to be put into the air in cities without permission (Avoki, 2017).

To gauge progress, many policies utilize outcome indicators. When interventions are chosen based on how they are projected to effect goals rather than how well they actually provide the advantages they were intended to bring about, Goodhart's law outlines what happens. To maximize the amount of rubbish collected for recycling while lowering the quality and value of items recovered owing to contamination, local governments in the UK, for instance, have implemented mixed recycling collections (Waste & Resources Action Programme, 2017).

The main advantage of recycling waste is that it decreases the amount of material that can be used to create new goods (Isenhour, 2010; Department of the Environment, Food, and Rural Affairs, 2011). Also, many people believe that the existing paradigm for policymaking is inadequate to address major global challenges like climate change, biodiversity loss, land degradation, deforestation, etc. (Biermann, 2021). Despite the fact that sustainability is a hot

topic in politics and science, most of humanity's development paths are not sustainable (Global Sustainable Development Report, 2019).

This is partly because sustainability science is based on a wrong model of nature and hasn't paid much attention to the real reasons why things aren't sustainable (Abson et al., 2017). Nature is often seen as a tightly connected, self-regulating, complex system that works best when people don't mess with it (Laitos & Wolongevicz, 2014). This is the opposite of how adaptively complex nature is.

In contrast to ecocentrism, which says that all of nature has value in and of itself, most policies have been anthropocentric (Biermann, 2021). Their main goal has been to protect and help people, who are thought to be more valuable than all other animals (Kopnina et al., 2018).

The idea that humans are separate from nature and ultimately not limited by planetary boundaries is based on a worldview of human exceptionalism and superiority to nature (Laitos & Wolongevicz, 2014), which supports the optimism of those who believe that human ingenuity and technology will "come to our rescue" (Hickman & Banister, 2009).

Systems thinking is just another "technology," an idea, or a fresh strategy that techno-optimists may use to address these problems. But is it possible to make and use these seemingly miraculous products? Is it easy to use systems thinking to change the way we do things in our daily lives?

2. The difficulty of putting systems thinking into action

“Engineers, politicians, and managers implicitly assume that they know how to think about systems, and most technical professionals do consider themselves to be systems thinkers. But (Valerdi and Rouse, 2010), there aren't as many people with these skills as these assumptions might suggest. According to research, learners' ability to think in systems is not currently being developed in education to its full potential (Palmberg et al., 2017).

Sterman and Sweeney (2007) say that even highly educated people with strong backgrounds in science, technology, engineering, and math (STEM) can't understand the basic parts of complex dynamic systems, such as feedback, stocks and flows, time delays, and nonlinearities. Plous's research from 1993 showed that people often used simple, linear cause-and-effect relationships to explain things, stopping their research as soon as they found a clear cause.

People also don't understand delays in systems, which could lead to "wait and see" actions that make problems worse (Sterman, 2000; Buehler et al., 2002; Faro et al., 2010). Even people with a lot of education can do poorly at systems thinking (Valerdi & Rouse, 2010). Many variables have come together to urge education officials to think in new ways about education provision, with systems thinking competencies higher on their agenda. This has led some to allude to a "learning crisis" (Ndaruhutse et al., 2019).

(Education Commission, 2016; World Bank, 2018; Lannon, 2018). While several authors (Hofman-Bergholm, 2018; Alnien & Pereira, 2021) contend that introducing systems thinking into education might help students develop a more comprehensive understanding of sustainability concerns, the available research on the efficacy of systems thinking programs varies (Verhoeff et al., 2018; Evagorou et al., 2009).

This means that policymakers may view sustainability concerns through their own discipline prism because they are not necessarily trained to do so. As a result, they may deploy strategies that are isolated and narrowly focused.

This claim is in line with the current "environmental policy" paradigm, which tends to favor sectoral solutions that are frequently created in isolation and tend to maintain the status quo while missing opportunities for significant systemic changes due to its inherent focus on narrow problem-solving (Biermann, 2021). (Ramos and Hynes, 2019).

(Hunt et al., 2021) Even laws that have good intentions and try to stop things haven't thought about what else might happen. There isn't a pre-made tool for systems thinking that can be used each time we encounter a challenging sustainability issue. Instead, getting a new, more in-depth understanding of sustainability requires critical and interdisciplinary thinking, the ability to take into account many academic points of view, look at the strengths and weaknesses of those points of view, and combine what has been learned from them.

Questions about assumptions and possible changes to the boundaries within or between fields (Mathews et al., 2008; Montana-Hoyos and Lemaitre, 2011) can lead to new ways of thinking about complex problems. Systems thinking makes interdisciplinarity possible because it provides a common thread of generalizable information that can be used to create a shared thinking space that goes beyond the boundaries of different fields (Barile & Saviano, 2021).

It also depends on the public being involved in research through deliberate, meaningful interactions that create chances for scientists and the general public to learn from one another (Stave, 2002). (American Association for the Advancement of Science, n.d.) In addition to

gaining knowledge, mutual learning means becoming more familiar with different points of view, frames, and worldviews.

It takes time and effort to bring about the necessary system changes by getting the public, policymakers, industry, and scientists to agree on the complexity of sustainability challenges. This is especially true now that more people agree that a "change of mind," "a profound shift of awareness," and changes at the level of a paradigm shift are needed (Laininen, 2019).

3. A paradigm shift in sustainability transitions is systems thinking.

In 1962, Kuhn used the phrase "paradigm shift" to describe the scientific transition from Newtonian to Einsteinian physics. Since then, Kuhn's work has been widely employed to describe system transitions. Hall (1993), for instance, used the idea to investigate the change from a Keynesian to a monetarist economic paradigm. According to Kuhn and Hall, a paradigm shift occurs when the anomalies and flaws of the current paradigm are consistently highlighted, the proponents of the new paradigm speak out loudly and confidently in support of it and are given positions of visibility and power, and effort is concentrated on winning over those who are most likely to be receptive to the change (Ramos and Hynes, 2019).

Partidário et al. (2010) found that there are often strong economic, social, and psychological incentives that keep society acting in ways that aren't sustainable. This is because the complex, multi-functional systems that cause sustainability problems are interconnected in many ways, both within and between them. So, there is a chance to affect the development of diverse macro-systems in a way that will positively alter the behavior of players (Nemeckseri et al., 2008). For example, (Noussan et al., 2020) measures could be made to control the demand for passengers and freight in a number of interconnected ways. This would help reduce the negative effects of the current transportation systems.

Many authors have written about how people's daily routines often force them to do things that aren't sustainable and are hard to change, even when it's clear that they're bad for the environment and sustainability (Henwood, 2019). (Henwood et al., 2016) says that the difficulty of changing unnoticed daily routines must reflect the ways in which people give their lives meaning and take into account lived experiences, routines, and the way they are socially and culturally organized.

No matter how thoughtful and concerned a person is, there are limits to how much they may diverge from prevalent consumerist norms (Isenhour, 2010). Institutions and socio-material arrangements that already exist, which are structural and require group action (Klintman and

Bostrom, 2015), determine a lot of how people act. Bostrom (2020) says that it is important to first understand the social life mechanisms that help to reproduce mass and excessive consumption in order to build the transformative learning capacity needed to achieve and legitimize top-down reformation or transformation of institutions.

It's clear that we need policies that push for big changes in society, politics, and institutions. (Bostrom et al., 2019) These policies should also give people choices for deliberate changes that address social problems like consumerism and bring about social, technical, and policy innovations that can break out of lock-ins and give people reasons to work toward prosperity goals that go beyond just surviving.

Bengtsson et al. (2018) say that these kinds of policies can help new management models that aim to change production and consumption in a fundamental way. One policy goal for change that can help with a paradigm shift and lead to sustainability is to help people shift their attention away from consumerism and back to "experiences, identities, connections, and values that matter to individuals. "Parkhill et al. (2015) say that policies need to include both specific policy initiatives and a system for "supportive governance" to help social resilience grow.

4. Changing how we think about sustainability issues to achieve the SDGs

(Voulvoulis & Burgman, 2019) Sustainability problems can be seen as the difference between the current situation (state A, which is not sustainable) and the desired state. Transitioning from the present unsustainable condition (A) to the intended state (D), which is the system's jointly envisioned future state of sustainability, is known as transformation (Kioupi & Voulvoulis, 2019).

There are many ways to close the gap or get where you want to go, but social problems arise when these ways are hard to understand, take a long time to develop, or people have different ideas about the best way to act. There is a need to "consider numerous routes seriously" since there is never just one important, workable approach, regardless of how precise the situation is (Scoones et al., 2020).

When defining the gap and assessing alternative paths, Smith & Humphries (2004) emphasize the need for improved inclusivity and multi-actor participation, and Funtowicz & Ravetz (1994) suggest expanding the peer community to include scientists along with industry, government, citizen groups, and environmental organizations.

The Sustainable Development Goals (SDGs) are the ends of the sustainability transformation, which is the change from the current unsustainable state to the intended state for society (Kioupi and Voulvoulis, 2019; Voulvoulis and Burgman, 2019).

Understanding the complexity of sustainability challenges, then, requires a change in how problems are structured. This means changing the way problems are defined into a more collaborative process that starts with defining the vision (the desired state) and then choosing the best way to "get there" using collective knowledge and skills from all fields and levels of assessment (Giakoumis & Voulvoulis, 2018b).

"Without action, vision is useless. Nevertheless, activity without vision lacks direction and purpose. Vision is vitally essential for directing and inspiring action. Also, when vision is widely shared and consistently kept in mind, new systems are created ", according to Donella Meadows (1941–2001), a pioneer in the application of systems thinking (Meadows et al., 1972).

A distinct, broadly held vision draws collaborators and resources and unites action (Zurcher et al., 2018). The road, or "radical change towards a sustainable society," is one of sustainability (Grin et al., 2010). This is the transformation necessary for the vision to materialize, and it is the focus of a whole field of study that has recently evolved in response to a growing interest among scientists and the general public in significant societal transformations toward sustainability (Loorbach et al., 2017).

Numerous analytical frameworks and tools are available for studying socio-technical transitions to sustainability, including "multi-level perspectives" (Geels et al., 2008; Kern, 2012; Papachristos et al., 2013; Wu et al., 2021), "transition management" (Berkhout et al., 2004; Köhler et al., 2019), and "niche experiments" (Sengers et al., Holmberg and Larsson, 2018).

System transitions can take decades because they involve changes to technologies, social practices, business models, rules, and social norms that are all connected. They also invariably involve conflicts about the direction and speed of change (Meadowcroft, 2011; Rosenbloom et al., 2018). Sustainability transformation requires a clear vision and commitment to the direction and rate of change required, as well as an understanding of the various aspects that contribute to the system's behavior (Sanwal, 2015).

Leverage points (areas where change is required) and a supportive atmosphere for change can speed up the process (Meadows, 1999). (Romero-Lankao et al., 2018) This includes projects

and plans to start such revolutionary changes, such as coordinated government action, private sector innovation, trial and error, and pressure from civil society.

For example, openness, transparency, diversity, and equity are thought to be necessary for sustainable transitions and have the power to change business and government, increase trust in institutions, encourage more public participation in decision-making, and more (CDP, 2020). Social equity, justice, and equality are also important parts of making a fair environment for people (Kioupi & Voulvoulis, 2019). They can also encourage changes in that direction.

(Patterson et al., 2017): Changes in sustainability can't happen without governments, politics, and policies. Change eventually starts having an impact on the overall structure of the system as positive feedback loops start to take hold as consumers become more accustomed to the new paradigm, green infrastructure is built, complementary innovations are commercialized and more favorable policy and regulatory frameworks are put in place (Fig. 1).

Kennedy et al. (2018) say that leverage is effective when the change mechanisms are doable and will move the system in a good direction, achieving the goal while limiting unintended side effects. Systems thinking enables interventions beyond 'end-of-pipe' solutions and towards addressing the deeper structures and mental models at the root of unsustainability, thereby enabling people to see the bigger picture and envision a sustainable human society, and thereby enabling the conditions for sustainability to emerge.

5.0. Summary, Conclusion, and recommendation

5.1. Summary,

The article, "Systems Thinking as a Paradigm Shift for Transformational Sustainability," explores the pivotal role of systems thinking in addressing complex and interconnected sustainability challenges. It underscores the need for a paradigm shift to achieve transformational sustainability and highlights the fundamental principles of systems thinking. Real-world examples and case studies demonstrate the successful application of systems thinking in various domains, fostering holistic understanding and collaborative decision-making. It acknowledges the challenges and barriers to embracing systems thinking, such as resistance to change and limited awareness, and calls for increased education, awareness, and integration of systems thinking into policy and decision-making processes.

5.2. Conclusion

Since the 1970s, environmental sustainability issues have been at the forefront of policy discussions and public concern. There have been some successes, but most of the problems have not been solved (Wiedmann et al., 2020). Although the notion of systems thinking has grown in popularity over time, interventions have not always been really systemic. This is sometimes because systems engineering and computational initiatives have placed too much attention on infrastructure rather than on people (UNESCO, 2005).

In fact, it has been found that most interventions to date, when ranked by their potential to change the system as a whole and improve sustainability, are partly driven by research methods and problem framings, with "deep leverage points" related to changing the system's rules, values, and paradigms rarely being addressed (Riechers et al., 2020). One possible reason for this is that most interventions focus on symptoms or "low-hanging fruit" when they should be developing new, more complex, path-dependent skills instead (Forés, 2019).

(Allen et al., 2019) To understand systems thinking, you need a new way of thinking about how change happens, how we connect to the outside world, and the web of relationships that make complex problems hard to solve. It involves comprehending the core reasons for unsustainability, the origins of the issues we confront, and the situations that encourage unsustainable behavior.

This goes beyond using root-cause analysis as a tool or just looking at cause-and-effect linkages. The term "root cause analysis" promotes a flawed reductionist view by suggesting—even unintentionally—that a single root cause (or a small number of causes) can be found, running the risk of simple linear narratives replacing more complex, and possibly fruitful, accounts of multiple and interacting elements (Peerally et al., 2017).

Stopping our current "misbehavior," for instance, "frequently treats sustainability as something that can be reached simply by quantitative analyses, technological advancements, plus whatever behavioral adjustments are needed to 'get us back to sustainability'" (Clark, 1994). Rees (2010) asserts that "modern *H. sapiens* is unsustainable by nature—unsustainability is an unavoidable emergent attribute of the systemic interplay between contemporary techno-industrial civilization and the ecosphere," adding that "human nature, cognition, and denial" are what prevent sustainability.

This story puts too much emphasis on our bad behavior and makes us change it without looking at why we do it, which leads to interventions. In reality, we don't often think about

why we do the things we do or how our dysfunctional habits as a society hurt the environment. Understanding what motivates our existing behaviors is necessary before determining what behavioral changes will actually "work."

On the one hand, humans will act in ways that are harmful to their own long-term survival if their biopsychosocial requirements (the "needs" our genes prescribe for us) are not addressed (Williams et al., 2021). On the other hand, these behaviors are part of intricate socioeconomic systems that are independent of human influence or control (Ewert, 2020). Complex systems have both individual and group behaviors, and the system structures are frequently the strongest impediments to behavioral change (Amel et al., 2017).

While science aids in the unravelling of this complexity, we are just now beginning to see the need to improve our ability to translate behavioral science discoveries into sustainable change (Reddy et al., 2017). This is not about targeted advertising, nudging, or other behavioral interventions (Linder et al., 2018, Ewert, 2020), which frequently cause people to feel guilty (Genevsky et al., 2013) and may have unintended or adverse impacts on their behavior (Lertzman and Baragona, 2016).

It aims to deepen our understanding of human behavior, the reasons behind people's decisions, the significance of external factors, and the mental models that underlie behavior. Systems thinking can help enhance public policy and market-based incentives to encourage global sustainability by understanding and expanding citizens' mental models (Garrity, 2018).

Contrarily, authorities and governments have primarily focused on changing the public's pro-environmental behavior in order to address unsustainability (Department for Environment, Food, and Rural Affairs, 2008; Department for Environment, Food, and Rural Affairs, 2011a; Department for Environment, 2011b; Dobson, 2010). This is despite a growing realization that our economic system, with its mandatory pursuit of unending industrial growth, is responsible for the planet's harm and the emergence of poverty (Sheth et al., 2011).

Systems thinking may show how diversionary such attention is and the contribution of the economic system to our unsustainable state (Shove, 2010). An examination of significant "industrial epidemics," which account for a significant portion of the present public health burden, provides important information on the subject.

"Our economic system permits free-ranging corporations to use evocative promotion, ubiquitous distribution, constant new product development, and seductive pricing strategies to encourage unhealthy consumption, the primary cause of the inevitable escalation of

lifestyle illnesses such as cancer, heart disease, and diabetes," states the World Health Organization. "Tobacco, alcohol misuse, and obesity have remained such intractable problems" (Hastings, 2012).

People often think of consumption as a choice they make on their own, but it is actually deeply rooted in behaviors, cultures, and institutions and is driven and supported by business and government practices (O'Rourke & Lollo, 2015). As a result, governments attempt to prevent these ills by focusing instead on consumers. Although consumers are accountable for the effects of their spending and lifestyle choices, governments are the ones who push large-scale changes in culture, consumption, and production patterns.

Businesses and policymakers are both choice architects, and policies create social norms, practices, and values through laws, infrastructure, pricing structures, and education (Kinzig et al., 2013). Most of the literature on sustainability transformations (Patterson et al., 2017) assumes that they can and must be launched, directed, controlled, and ruled. This may seem counterintuitive to bottom-up systemic transformations, which have a better chance of happening and being accepted.

In fact, "command and control" approaches to systemic problems don't recognize change as a really systemic process that resists the top-down and bottom-up dichotomies that cause disagreements and resistance, especially from those who are "being transformed" (Stirling, 2015). However, in this situation, systems thinking and public involvement may be extremely beneficial as a strategy for empowering individuals to address problems and have an impact on decisions that will affect their lives.

Due to their shared vision of a sustainable future, they may then decide together what has to be done and how, "raising issue ownership and hence the odds of both proposition acceptance and implementation success" (Kirkman & Voulvoulis, 2017). Understanding the underlying forces, connections, and circumstances that affect our choices can help us talk about them in new and creative ways and give us a broader view of time and space, which could help prevent or reduce unintended consequences.

It is the deliberate process of understanding how to change the parts and structures that affect how a system works and finding places where small changes can have big effects on the system as a whole. People who are empowered by systems thinking become aware of their own power and learn how to be independent, involved, and well-informed citizens with a clear vision of the sustainable future they want.

To solve sustainability problems, it's best to come up with solutions that work well together, last a long time, and show a thorough understanding of the major forces that drive and stop change. Change happens in a political system that is complicated and made up of a network of institutions, interest groups, personal leaders, and people.

We have to accept that sustainability problems are not easy to solve, since there are no simple answers or quick fixes. Problem-solving in a democratic, dynamic, and diverse society primarily relies on informed, critical-thinking, and engaged citizens. We all still bear individual responsibility for remaining informed and involved and maintaining the integrity of institutions like the government.

Governments have special abilities, resources, and power to establish institutions and networks and assist structural socio-economic change through both direct policy interventions and by paving the way for the emergence of substitute sustainable economies. We should hold them accountable for how well they do on this.

5.3. Recommendations:

The adoption of systems thinking as a paradigm shift for achieving transformational sustainability represents a critical turning point in our approach to addressing the complex and interrelated challenges facing our planet. This introduction sets the stage for a series of recommendations aimed at harnessing the power of systems thinking to drive sustainable change.

Systems thinking offers a holistic perspective that recognizes the intricate web of relationships, feedback loops, and dynamic interactions that shape our world. It enables us to transcend reductionist approaches and confront sustainability issues in their full complexity.

In the following recommendations, we explore practical steps to promote systems thinking in various spheres of society. From education and awareness campaigns to interdisciplinary collaboration, policy integration, and corporate adoption, these recommendations seek to pave the way for a more sustainable future. We emphasize the need for continual evaluation and adaptation to ensure that systems thinking remains a dynamic and evolving tool for addressing the pressing challenges of our time.

- **Promote Systems Thinking Education:** To foster a culture of systems thinking, educational institutions, from schools to universities, should incorporate systems

thinking principles into their curricula. Professionals across various sectors should also receive training and workshops on systems thinking.

- **Awareness and Outreach:** Governments, NGOs, and sustainability advocates should engage in extensive awareness campaigns to promote the benefits of systems thinking. This includes organizing seminars, webinars, and public discussions to educate the general population about its relevance to sustainability.
- **Interdisciplinary Collaboration:** Encourage and facilitate collaboration among diverse stakeholders, including scientists, policymakers, business leaders, and community representatives. Cross-disciplinary initiatives can help generate innovative solutions to sustainability challenges.
- **Policy Integration:** Governments and international organizations should integrate systems thinking into their policy-making processes. This can involve establishing dedicated sustainability committees or task forces that employ systems-thinking approaches when developing and evaluating policies.
- **Corporate Adoption:** Encourage businesses and organizations to incorporate systems thinking into their sustainability strategies. This includes assessing the full impact of their operations on the environment and society and seeking opportunities for holistic improvements.
- **Research and Case Studies:** Fund research initiatives that explore the practical applications of systems thinking in different contexts. Encourage the publication of case studies that showcase successful outcomes achieved through systems-thinking approaches.
- **Evaluation and Adaptation:** Continuously assess and adapt systems thinking methodologies to address evolving sustainability challenges. Encourage regular evaluations of the effectiveness of systems thinking in achieving transformational sustainability goals.

Incorporating systems thinking as a fundamental approach to sustainability can lead to more comprehensive and effective solutions, ultimately driving the shift towards transformational sustainability.

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