sustainability

MDPI

Concept Paper

What Are the Stimuli to Change to a Sustainable Post-COVID-19 Society?

Cecilia M. V. B. Almeida [1,2,*], Biagio F. Giannetti [1,2,*], Feni Agostinho [1,2], Gengyuan Liu [2] and Zhifeng Yang [3]

[1] Laboratório de Produção e Meio Ambiente, Programa de Pos-Graduação em Engenharia de Produção, Universidade Paulista (UNIP), São Paulo 04026-002, Brazil; feni@unip.br
[2] School of Environment, Beijing Normal University, Beijing 100091, China; liugengyuan@bnu.edu.cn
[3] Institute of Environmental and Ecological Engineering, Guangdong University of Technology, Guangzhou 510006, China; zfyang@gdut.edu.cn
* Correspondence: cmvbag@unip.br (C.M.V.B.A.); biafgian@unip.br (B.F.G.)

Abstract: The COVID-19 crisis has highlighted how inadequately prepared humanity is to manage global disasters. Conversely, this crisis also offers an exceptional opportunity to move towards a more equitable and sustainable future. This paper explores three stimuli that can lead people to the change towards sustainable Post-COVID-19 societies: crises, knowledge, and alternative paradigms. From a theoretical approach, the paper addresses the roles of each stimulus and the capacity they may have, individually or together, to encourage the debate about the relationship between environmental conditions and human crisis. This study contributes to the discussions on the importance of strategic transformations of the global consumption and production systems. It takes this unique opportunity to move towards a more sustainable future. Moreover, it urges that this transformation process be articulated with alternative paradigms that seek to go beyond inequalities, conflicts, imbalanced development, and ecological deterioration.

Keywords: sustainable change; crisis; knowledge; alternative paradigms; cleaner production

Citation: Almeida, C.M.V.B.; Giannetti, B.F.; Agostinho, F.; Liu, G.; Yang, Z. What Are the Stimuli to Change to a Sustainable Post-COVID-19 Society? *Sustainability* **2021**, *13*, 12939. https://doi.org/10.3390/su132312939

Academic Editor: Ricardo García Mira

Received: 27 September 2021
Accepted: 10 November 2021
Published: 23 November 2021

1. Introduction

The COVID-19 has motivated extensive discussions on the future the society should look forward to after the pandemic, which caught the global community unprepared to respond to the crises caused by this virus appropriately. Many societal leaders were unprepared for such crises, and many socio-economic and ecological crises were experienced.

The change to sustainable post-COVID-19 societies calls for a massive restructuring of the disconnected way the present society deals with the environment. Specifically, the belief that the Planet is an unlimited supplier for humankind needs urgent adjustment. Regrettably, proper altering of the current pattern is hindered by a lack of knowledge of humanity's environmental and sociological nature, which is indispensable to prevent failures and warrant a peaceful path towards sustainable development (SD).

The first criticisms of SD drew attention to the subject of what was to be sustained and for whom [1–4]. This debate considers intra- and intergenerational equity essential to integrate the SD discourse [5,6]. Equity between generations is understood as equally distributing resources, economic wealth, and natural capital to the current population, leaving the same amount and quality of resources for future generations. Intra- and intergenerational equity are among the primary objectives of all significant environmental conventions and declarations. The first principle of the Stockholm Declaration established the "*solemn responsibility to protect and improve the environment for present and future generations*," and the second enunciated that "*the natural resources of the Earth . . . must be safeguarded for the benefit of present and future generations*" [7]. In 1992, the third principle of the Rio Declaration established inter-generational equity as "the right to development . . . fulfilled to meet developmental and environmental needs of present equitably and future generations" [8].

The UNESCO Declaration on the Responsibilities of the Present Generations toward Future Generations supplemented details for intergenerational equity, highlighting the responsibility of the present generations to the future ones regarding environmental, cultural, and social aspects [9].

Though many declarations and conventions recognize and reaffirm these principles, implementing and conceiving intra- and intergenerational equity policies, SD context is weighed down by an intrinsic antagonism. Although a growing part of the society recognizes that there are limits to the Planet's sustainability, another part is still compelled to reject that human activity's growth and increasing consumption cannot continue. Some of the practical issues associated with applying intergenerational equity were highlighted more than 30 years ago by Edith B. Weiss [10], who proposed three basic principles of intergenerational equity: (i) to maintain "comparable options", each generation should conserve cultural and natural resources in a way that future generations can use the natural resource base to satisfy their values; (ii) to maintain "comparable quality" by ensuring the quality of the environment between generations—each generation should conserve the quality of the environment, at least, in the same state in which it was received; and (iii) to maintain "comparable access" by assuring equitable access among generations to the Planet's resources.

These three principles also highlight the duties of the present (and future) generations: to conserve resources, avoid impacts, prevent disasters, and compensate for environmental damages. In this context, it became clear that to achieve intergenerational equity; the carrying capacity would have to be seized as the maximum load an environment can enduringly hold without reducing its capability to sustain future generations—remarking that load refers not only to the number of individuals but also to the consumption they make [11–14].

The change sustainable post-COVID-19 societies is a pressing issue that must gather political, economic, and scientific attention. The primary reason that can be ascribed to this change is the unregulated and ruthless activities of mankind, including industrialization and unsustainable consumption behavior. This reckless development strategy led humanity to struggle with the outbreak of the coronavirus disease and the social and economic consequences resulting from the worldwide pandemic. Thus, the central question of the present time is: What could stimulate humanity to change the way it conducts its production and consumption patterns?

This paper addresses this question by analyzing the roles of crisis, knowledge, and alternative paradigms as drivers to sustainable societies.

2. Three Stimuli to the Change towards Sustainable Post-COVID-19 Societies

Traditionally, crises, knowledge and alternative paradigms interact randomly in a trial and error way, encouraging people to change (Figure 1). The knowledge accumulated from past experiences may spare trial-and-error, and alternative paradigms may change the way humans deal with a crisis.

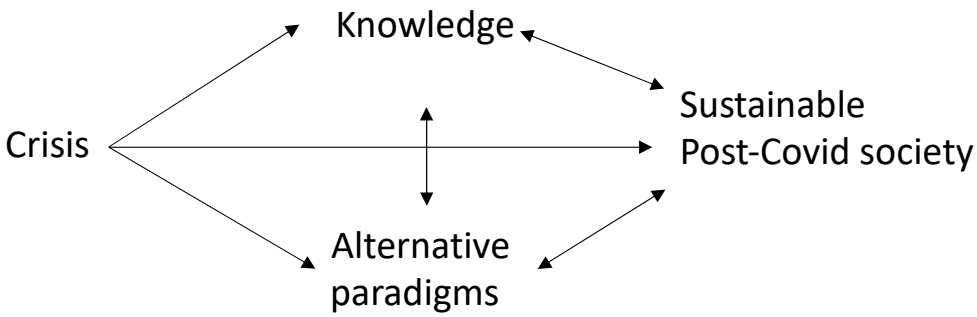

Figure 1. Traditional roles of crisis, knowledge, and alternative paradigms as stimuli for people to change to sustainable post-COVID-19 societies.

Cleaner Production concepts and practices have experienced extraordinary success since their introduction in the 1980s and are currently an essential part of the plan of corporations and governments. Its goals became essential to academic research worldwide. The field progressed as a scientific branch, especially by integrating theory, applied science, and policy, making relevant contributions to sustainable development, and introducing a pioneering disciplinary blending across fields.

2.1. The Role of Crisis

The term crisis may include food scarcity, illness, energy shortage, overpopulation, poverty, unemployment, deforestation, biodiversity loss, and a lack of economic growth. The term also is associated with short-term episodes or incidents that cause commotion and fear in society, accelerating and intensifying the perception of what can happen if a healthy environment is missing. The term crisis describes a series of specific problems and conditions at different historical moments in the scientific literature.

Past experiences showed that crises created by human activities, such as the current COVID-19 pandemic; also Bhopal,1984, the meltdowns of the nuclear reactors at Three Mile Island, 1979; Chernobyl, 1986; and Fukushima, 2011, trigger fears and values [15] in a reactive and amplified manner and can generate responses as alternative paradigms and effective (or not) changes (Figure 2). Past experiences also showed that large resource depletion, overconsumption, overpopulation, and non-equitable distribution might lead to a wide-ranging crisis. The scale of the crisis depends on the temporal and spatial extent of resource depletion. Several crises have evolved around an ongoing and complicated reunion among the global organization of economies, ecologies, and cultures [16].

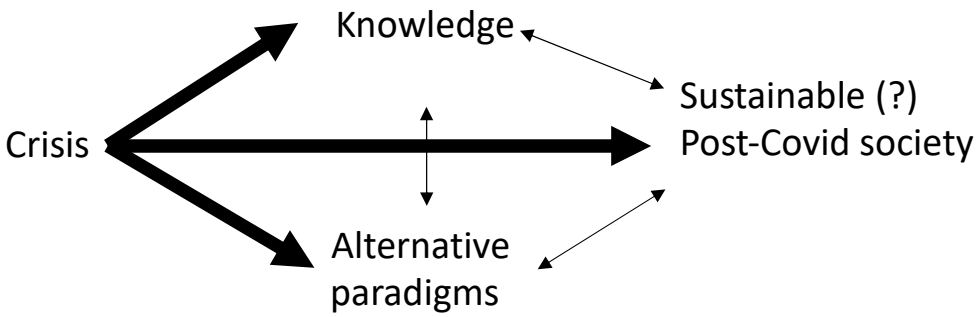

Figure 2. Crisis as a stimulus for people to change sustainable post-COVID-19 societies.

There is no agreement in the literature about the role and the effect of crises on human motivations and actions. The economic inequality and the environmental crisis, both intensified since the 1950s, resulted in pressures and changes in natural ecosystems [17–21] considered mutually reinforcing [22,23]. Concerning the social-economic-environmental ongoing crisis, questions were raised about inequality's role in environmental deterioration [24]. Some researchers claim that the COVID-19 crisis is a direct cause of the ecological crisis and prevents its resolution [25], considering that inequality leads individuals to adopt consumerist and individualistic behaviors toward the environment [26]. Heerink et al. [27] stated that inequality involves the concentration of affluence amongst wealthy groups, more aware or informed, whose activities produce less environmental pressure. However, the idea that more affluent consumers necessarily change their consumption behavior in favor of the environment was opposed by Fleurbaey et al. [28]. The latter found that environmental values explain only about 20% of behavioral adjustment toward climate change. This low percentage was explained by competition of concerns (environmental concerns against the desire for more energy-intensive transportation or housing), in which rich people engage mixing wishes with their facility to attain a higher standard of living. Other researchers, such as Scruggs [29], defended an opposite view affirming that concentrated wealth in situations of great inequality may promote environmental protection policies.

Nevertheless, some researchers identify that wealthier people can, willingly or not, transfer the costs of environmental degradation due to their consumption to other locations and continue their harmful practices without suffering the consequences [30,31]. Bina and Camera [32] analyzed six international-scale responses to the economic and climate change "double crisis". They concluded that policy responses fail to attain what is considered necessary to mitigate the environmental crisis and inequality from an ecological economics standpoint.

Before 2019, the most known example of the cumulative or ongoing environmental crisis was climate change that especially inflamed anxiety because of the lack of conviction as to if this crisis could be solved or not. The belief that carbon emissions are reaching a tipping point [33–35] and that climate change issues require not only individual efforts but also the participation of governments and major corporations causes a "good pessimism", motivating people [36–38]. After 2019, the current COVID-19 crisis has emphasized the problems that may arise from a degraded biosphere. It shows that human societies are vulnerable, unevenly equipped, and unprepared to cope with global calamities [25].

At this point, the probable most important question still pending is: Do crises stimulate us to make the essential changes? Defining crisis as "a phase—of short or long-term—of disorder in the apparently normal development of a system", Boin et al. [39] affirm that society, due to extensive alarm, faces an urge to act. But, in general, both the most important issues of a particular crisis and any solution to it are at least imprecise and frequently theoretically or technically beyond the skill of governments and the general public to apprehend. When the causes and effects of a crisis are complex, uncertain, and comprise different scales, it becomes important to search for opportunities to change, particularly when crises endure [16,40].

The present environmental crisis is multifaceted and encompasses a broad array of ecological problems, such as global warming, toxic waste release, air and water pollution, ozone layer depletion, deforestation, desertification and soil erosion, and biodiversity loss. The variety of environmental problems involves a combination of causal factors. Some issues are local, others global [40]. Some are the result of consumption patterns in the wealthier countries, and others are the product of the pressure of population and development in the poorer nations. In this scenario, policies formed based on single perspectives are doomed to fail [41,42], and what differentiates the reaction for each type of crisis is the response time given by society.

In both cases, short-term episodes and ongoing crises, the societal response is reactive. Big incidents tend to catalyze reactions [15], and society provides a boom of responses. Ongoing crisis grants an opportunity to forge more productive links between trial-and-error on socio-economic-environmental systems to accomplish a broader transition. Responses to crises occur under a reinforcement learning method with which appropriate responses for solving problems result from trial-and-error. The benefit is that reinforcement learning can be helpful to solve uncertain or unknown problems but needs a long time to complete the trial-and-error cycle [41,43,44].

2.2. The Role of Accumulated Knowledge

Suppose there is previous information about society's problems to promote the change to sustainable post-COVID-19 societies. In that case, a quantity of trial-and-error can be spared, and restructuring the way humans deal with the environment can take a shorter time. We also learn from past experiences that, in the 20th-century, knowledge was able to act as a catalyst for the transformative environmental movement such as Rachel Carson [45]. Her ideas helped incite a process of transformative consciousness in society, and *Silent Spring* [46] inflamed the environmental awareness of the 1960s. The environmental problems were revealed to a broader audience supplying values and fears but transformed more than that, the bridge across science and policymaking. The effect of Carson's book on environmental policymaking provided a historical precedent for contemporary discussion on global warming, cancer studies, and nuclear power. Joining Carson in this endeavor,

other distinguished scientists revealed the threat to our society from problems regarding overpopulation [47], the environmental cost of economic growth [48,49], the interactions of human activities and the consumption of nonrenewable natural resources [50,51], and the emergence of zoonotic infections, such as SARS-COV1, MERS, or swine or bird influenza [52]. The deterioration of biodiversity decreases ecosystem functioning and reduces the protective effects of biodiversity against infectious diseases, suppressing the regulation and dilution of pathogen reservoirs [53,54].

Over the years, The scientific literature has provided several alternatives to motivate and contribute to the change in theoretical and applied studies to various systems from small to large scale. Supported by this previous information, society may mitigate errors and shorten the time to initiate and implement the changes required to deal with a future with limited resources. Changes may occur by mimicry [55,56] or by repeated cycles of replication, variation, and environmental interaction [57,58], and a more complex model arises as the scientific debate highlights the inadequacy of the reactive model (Figure 2). Societal feedback and cycling loops developed through scientific debate helped generate new ideas, among which Industrial Ecology [59] and Industrial Metabolism [60,61] achieved a prominent position over the last 30 years. More recently, Circular Economy [62,63] appeared as a reinforcement, increasing awareness to accelerate the creation of appropriate solutions that can help promote changes that effectually lead to SD.

Crises and the required changes must be mediated by accumulated knowledge and examined under alternative paradigms acting as a converging lens (a beam of light passing through it is brought to a focus—the change to sustainable post-COVID-19 societies; Figure 3). The mediation of knowledge and alternative paradigms (enclosed within the lens) reflects the view that human experience could accelerate the desired change and help mitigate the role of crisis and tie social progress to environmental limits [47]. Environmental management systems, either planned or spontaneous, become prevalent, and it is equally conceivable to envision those successful changes in social activities would encourage the emergence of more changes.

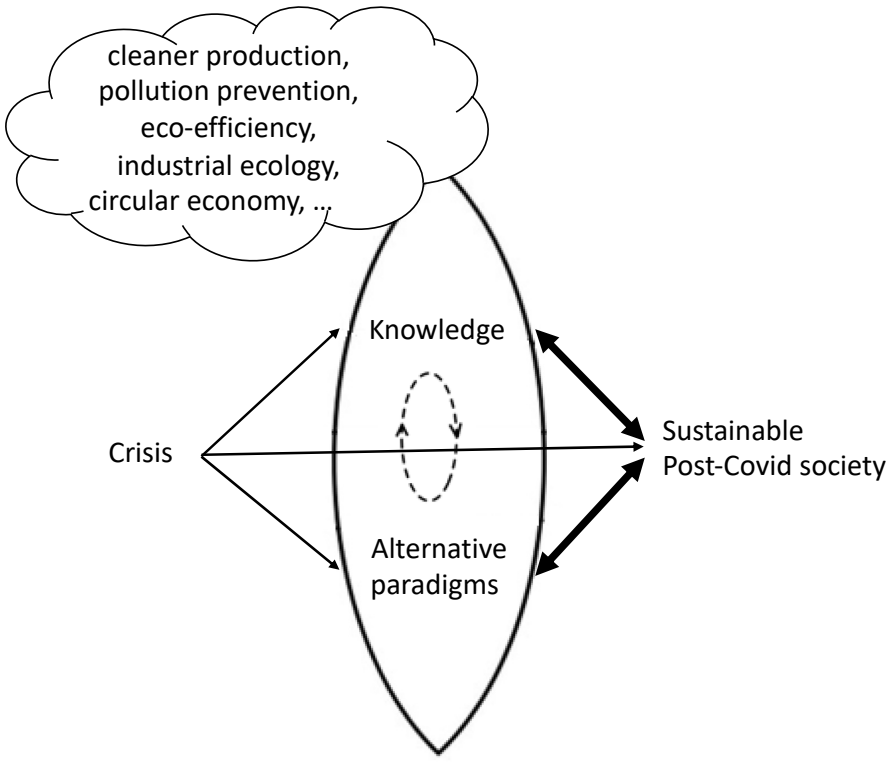

Figure 3. A convergent lens: the role of stimuli for people to change mediated by scientific knowledge and alternative paradigms.

When mediated by scientific knowledge and alternative paradigms, a societal response is partially reactive and partially proactive. Despite the improvement concerning the reactive model (Figure 2), the scientific mediation still faces a challenge concerning vocabulary alignment and dispersed literature to spread and popularize the knowledge gathered in scientific journals [64]. There is also a concern that new ideas can increase demand for resources and pressure on the environment [65,66]. An ongoing debate points to the increased rebound effects in sustainable agriculture [67,68], in material use [69,70], and on new types of consumption that can result in new applications of resources of a limitless or unknown character [71,72]. Thus, in addition to scientific/technological development, an intensive search for innovative, more comprehensive, paradigmatic approaches to conduct human motivation, understanding, and action seems logical.

2.3. The Role of Alternative Paradigms

The combination of academic contributions with the concepts of sustainable development may encourage the emergence of alternative paradigms and could represent the first step towards SD. A paradigm is nothing more than the capacity of perception of reality by a predominant part of society. The "*paradigms are scientific achievements universally recognized that, for a time, provide a model for problems and solutions for a community*" [73]. Time is a key concept here, in which different stages for human development should be based on different paradigms. Thus, in the same way, the development of most sciences have been characterized by continuous competition among different conceptions of nature, the development of a sustainable post-COVID-19 society may be guided by a paradigm different from the neoclassical one based exclusively on the growth of the gross domestic product [74,75]. The substitution may occur by desire or need. The contribution of the world perception may help design and move towards an alternative paradigmatic basis for SD able to implement and maintain real, high wellbeing levels across all societies [76].

In the model shown in Figure 3, humans can more or less control their environment, for better or worse. Increasingly, public and scientific debates have taken the form of asking empirically oriented questions about humanity's socio-economic and technological influence on the Biosphere and its biogeochemical processes: Which processes are the most important? What are the major problems? How can we establish priorities? When is the right time to act? To what extent solutions may be applied?' [77]. Such a model should reckon that mankind can impose itself as an instrument of direction and control upon the environment interacting not just between each component but through a social complex comprising three elements: change, knowledge, and alternative paradigms (Figure 4). Through the divergent lens, it is plausible to imagine that the role of crisis is minimized in effect and occurrence. For eco-social purposes, this representation enables thinking of knowledge and alternative paradigms as stimuli and consequences of change.

Table 1 briefly describes three theories that could be the basis for a paradigm change. Despite the many other theories that can help alternative paradigms succeed, these theories were chosen because they reflect a different mental model concerning the stability of society, the environment, and the economy. The Gross National Happiness is directed to social concerns, The Prosperous Way Down is environmentally centered, and degrowth is based on the economic view.

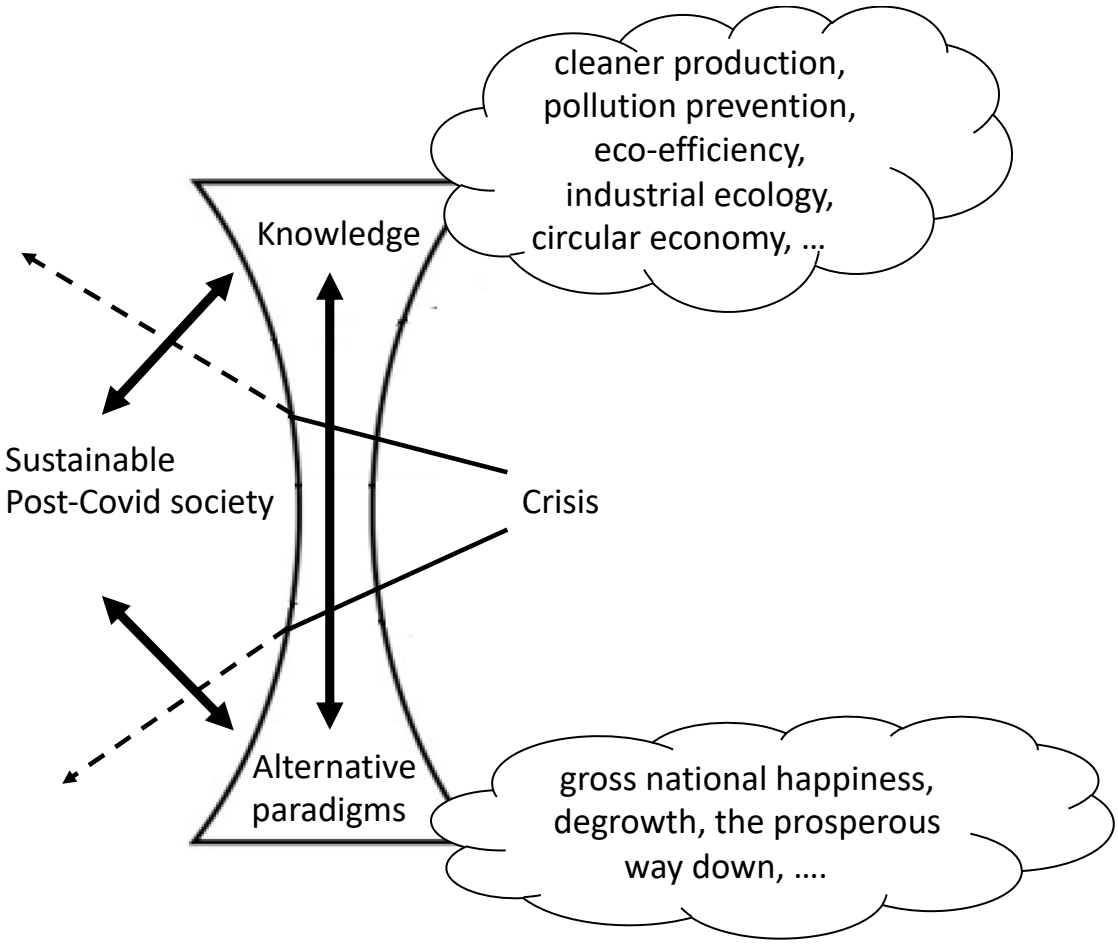

Figure 4. A divergent lens: interaction of stimuli for people to change to sustainable post-COVID-19 societies.

Table 1. A brief description of selected theories may lead to the needed paradigm changes and the subsequent urgently needed societal behavioral changes.

Mental Model	Theory	Main Ideas
Social	Gross National Happiness	The GNH is a conceptual, philosophical, and political framework designed to measure the population's general level of wellbeing [78]. The four pillars of GNH are proper governance, promoting SD, conservation of the natural environment, and preserving cultural values.
Environmental	The prosperous way down	Progress, wellbeing, and happiness should adapt, respecting the Planet's capacity in providing resources and environmental services [11,12].
Economic	Degrowth	Refers to an equitable downscaling of consumption and production assuring human wellbeing and ecological conditions [79,80].

Through time, the scientific literature provided ideas to encourage changing the way people perceive the world. Some of them had already reached the general public, such as the Gross National Happiness (GNH, http://www.grossnationalhappiness.com—[78], accessed on 15 May 2021), the Natural Step (http://www.thenaturalstep.org/—[81], accessed on 15 May 2021), and the Ecological Footprint (http://www.footprintnetwork.org/—[14], accessed on 15 May 2021), providing information on initiatives, education, materials, and energy consumption, consultative work, research and innovation through non-profit organizations or websites. But new ideas are also becoming popular, such as the Green Economic Initiative of the United Nations Environment Programme [82], dedicated to improving human social equity and wellbeing and reducing environmental risks and resource

scarcity. The Blue Economic claims that each innovation in the business models is moved by science (http://www.theblueeconomy.org/Home.html, accessed on 15 May 2021). Finally, although not completely solving the issue regarding 'time' when dealing with sustainability [83], the most popular Circular Economic ([84], www.ellenmacarthurfoundation.org) focuses on closing the loops for material and energy flows aiming to contribute to long-term sustainability. However, there are still promising combinations of mental models [84–86], in which metrics originally created to appraise environmental issues are used to support the economy [74]. All they could support the establishment of a new paradigm for societal development, helping man understand the current and future challenges for its survival on the Earth.

3. The Potential of Stimuli in Affecting the Earth Carrying Capacity

Human societies have transcended carrying capacity limits through development and technology and accomplished in appropriating portions of life-supporting capacity from other species of the Planet. Constantly, the human population increased without considering resource scarcity and environmental health [14,87]. Currently, the economy grows along with wellbeing and happiness at the expense of the carrying capacity. For modeling the roles of crises, knowledge, and alternative paradigms stimulating people to change to sustainable post-COVID-19 societies, it is important to expand the concept of carrying capacity, including the use of fossil fuels and nonrenewable resources the basic and subjective social drivers.

The concept of carrying capacity clarifies that for any environment usage by a population, there is an amount and extent of use that, when exceeded, degrades the environment's suitability. With this in mind, what should be the stimuli to change to sustainable post-COVID-19 societies, in which the Planet's carrying capacity is the limiting factor? In Figure 5a, the carrying capacity is represented by curve B and the actual load by curve A. I represents the intensity of relative impacts produced by human activities (such as per capita consumption, per capita nonrenewable usage, per capita air emissions, etc.), and Q represents the absolute amount of impact, such as the total consumption, rise in temperature, increasing population. Quantitatively, the environment's carrying capacity for mankind is set, according to von Liebig's law [88], by the constant flow rate of the least abundantly available necessary resource (material or energy). The load is the product of two dimensions: the quantity of limiting resources multiplied by the intensity of use. A sustainable load (Figure 5a, curve A) is a load that does not exceed the rate of supply (Figure 5a, curve B). As long as the area of the rectangle remains below curve B, we have a representation of a sustainable load. Past experiences may help to maintain this situation as long as the limiting resource is available. In the same way, alternative paradigms may help people change their perspectives about development and wellbeing [89].

The load may have different shapes according to the effectiveness of the changes resulting from each model. Curve A may change position according to the intensity of impact (Figure 5b), representing, for example, an increase in energy per-capita consumption without a corresponding reduction in the human population. Alternatively, as shown in Figure 5c, we could have an overload where the per capita use level has decreased, and there is no tradeoff enabling the load to remain sustainable. Despite all efforts made to change to sustainable post-COVID-19 societies, a catch lies in the belief that replacing materials or technological advances will solve all problems [1]. Resource depletion affects future energy/resources available; their relative scarcity deepens, and over time, crisis and environmental burden become less and less reversible. Humanity's dependence on ecosystems exposed by the Covid19 crisis is the current example of the magnitude of our resilience towards an uncertain future [25]. Figure 5d shows a situation where human activities exceed the capacity of the Planet (e.g., consuming the entire amount of a nonrenewable resource—such as fossil fuels) and that the carrying capacity is decreased due to a lack of reinforcement on the natural environment.

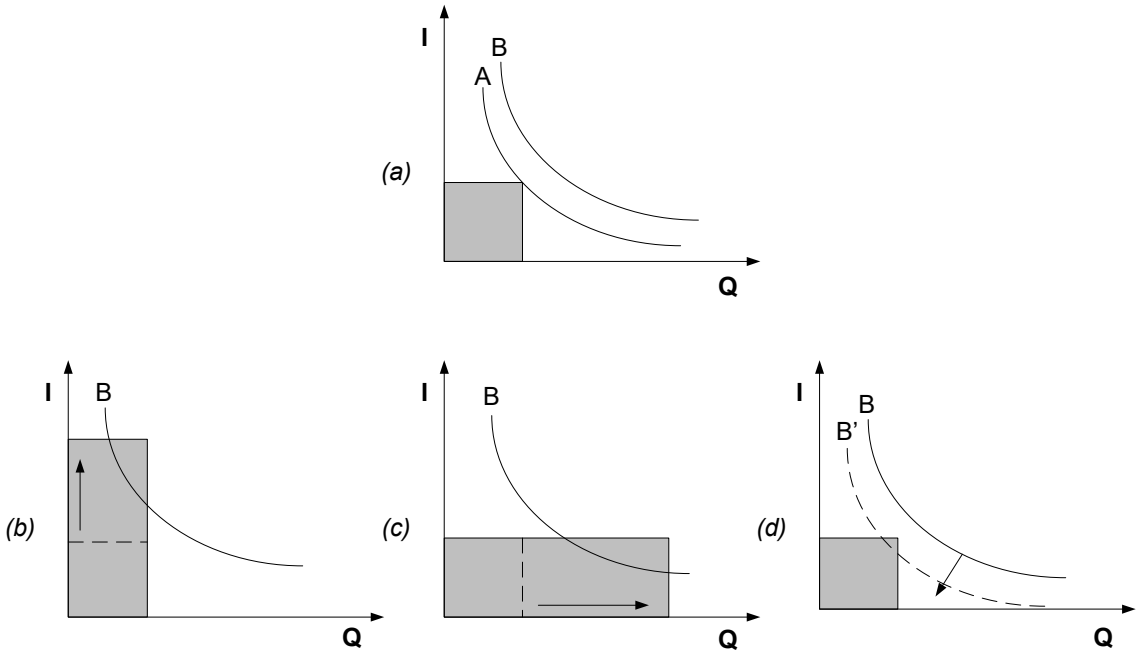

Figure 5. Load (gray rectangles) is the product of two dimensions: the intensity of impacts (relative impacts) and the number of absolute effects. (A) sustainable load (I × Q) must not exceed the sustained supply rate (B), the carrying capacity. An increase along one axis of the graph must be compensated by a decrease in the other dimension, never exceeding B to be considered sustainable.

In the long term, the continuance of using reactive models (Figures 1 and 2) clearly will not provide the desired transition. Also, despite the improvement supplied by the condition shown in Figure 3, in which changes and crises are mediated by knowledge and alternative paradigms, it is impossible to determine how long it will take for the interactions among stimuli to cause beneficial changes. The adoption of the model shown in Figure 4 is the most appropriate. It is worthy to note that the question of a load's sustainable extent is an objective ecological problem and not a value subject. The question of which tradeoff is worthier than another is a matter of value. Deciding whether to increase the consumption of some at the cost of lowering the standard of living of others or to raise material comfort at the expense of population cutback depends on a value decision. However, it is a grave inaccuracy to assume that value replaces the objective meaning of carrying capacity.

The population has increased enormously, and technological progress, especially in the last two centuries, has led to increased resource consumption, particularly those with high carbon content. As human activities increase, the amount of energy/materials each person consumes increases, and the availability of natural ecosystems and their services decreases [90,91]. Forecasting that all developing countries can sooner or later be as industrialized as developed ones have become [89] is equivalent to envisioning a world populated several times the actual population [13], reflecting a sorrowful lack of knowledge of the ecological cost of threatening the planet's carrying capacity. The time has come when inappropriate must be recognized and avoided [92,93]. In the change to sustainable post-COVID-19 societies, loads can develop merely on one axis while decreasing on the other (Figure 5b,c). If not, our inheritance to future generations will be a smaller carrying capacity (Figure 5d) and the human distress it will lead to.

Although sustainable development discourse is mainly tied to environmental aspects, it is also a driver for determining value choices related to equity issues for present and future generations. However, divergences on equitable distribution of finite resources should not outshine the fact that the environment is not always capable of recovering when loads go ahead of the carrying capacity.

4. Concluding Remarks

The conviction that humans are responsible for adjusting the Biosphere through technology and science rests on the impression that the Biosphere can be changed by knowledge and actions. This vision states that the Planet can be recomposed through intentional, large-scale human actions on the natural environment. The result is a planet in which the environment is altered (perchance damagingly) but in which human actions provide the prospective for longer-term sustainable management or development. This paper provides a theoretical discussion about how crisis, knowledge, and alternative paradigms can engender change, the connections and conflicts that arise, the values expressed and suppressed, and the intended and unintended consequences. Recognizing the multidisciplinary character of human society, knowledge and alternative paradigms are proposed to orient mankind toward a promising future, representing an optimistic contribution to human evolution in its deeper and true meaning.

Each of the three stimuli discussed can act as a possible means to perpetuate and evolve or progress toward sustainable post-COVID-19 societies. Suppose knowledge and alternative paradigms can motivate and help select which environmental management maximizes socio-economic vitality with less trial and error. In that case, society may improve efficiencies, innovate with fewer failures, and adapt to change more rapidly. Simple as this discussion is, it illustrates a critical aspect of the change to sustainable post-COVID-19 societies, which can be associated with the concepts of carrying capacity contributing to a vision of the future.

Author Contributions: Conceptualization, C.M.V.B.A., B.F.G.; Formal Analysis, F.A., G.L.; Resources, C.M.V.B.A., B.F.G., F.A.; Writing—Original Draft Preparation, C.M.V.B.A.; Writing—Review and Editing; F.A., G.L., Z.Y.; Supervision, C.M.V.B.A., B.F.G.; Project Administration, C.M.V.B.A., Giannetti. All authors have read and agreed to the published version of the manuscript.

Funding: This research received no external funding.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: Not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Gonella, F.; Almeida, C.M.V.B.; Fiorentino, G.; Testoni, R.; Zucaro, A. Is technology optimism justified? A discussion towards a comprehensive narrative. *J. Clean. Prod.* **2019**, *223*, 456–465. [CrossRef]
2. Thrupp, L.A. Legitimizing local knowledge: From displacement to empowerment for Third World people. *Agric. Hum. Values* **1989**, *6*, 13–24. [CrossRef]
3. Martinez-Alier, J.; O'Connor, M. Distributional Issues: An Overview. In *Handbook of Environmental and Resource Economics*; van der Bergh, J., Ed.; Edward Elgar: Cheltenham, UK; Brookfield, VT, USA, 1999.
4. Redclift, M.R. *Sustainable Development: Exploring the Contradictions*; Methuen: London, UK, 1987.
5. Escobar, A. Imaging the post-development era: Critical thought, development, and social movements. *Soc. Text.* **1992**, *10*, 20–56. [CrossRef]
6. Sachs, W. (Ed.) Global Ecology. In *The Development Dictionary; A Guide to Knowledge as Power*; Zed: London, UK, 1992.
7. Stockholm Declaration of the Human Environment, Report of the United Nations Conference on the Human Environment, UNEPOR, June 16, 1972, UN.Doc.A/CONF.48/14/Rev.1, 1973) Principle 1 and 2. Available online: https://digitallibrary.un.org/record/523249 (accessed on 17 November 2021).
8. Rio Declaration on Environment and Development, Report of the United Nations Conference on Environment and Development, UN Doc. A/CONF.151/26/Rev. 1 (1992), Principle 3. Available online: https://www.un.org/en/development/desa/population/migration/generalassembly/docs/globalcompact/A_CONF.151_26_Vol.I_Declaration.pdf (accessed on 17 November 2021).
9. UNESCO. Declaration on the Responsibilities of the Present Generations towards Future Generations. In Proceedings of the 29th the General Conference of UNESCO, Paris, France, 12 November 1997.
10. Weiss, E.B. *In Fairness to Future Generations: International Law, Common Patrimony, and Intergenerational Equity, The United Nations University*; Transnational Publishers: New York, NY, USA, 1989.
11. Odum, H.T. *Environmental Accounting: Emergy and Environmental Decision Making*; John Wiley & Sons: New York, NY, USA, 1996.

12. Odum, H.T.; Odum, E. The prosperous way down. *Energy* **2006**, *31*, 21–32. [CrossRef]
13. Wackernagel, M.; Hanscom, L.; Lin, D. Making the Sustainable Development Goals Consistent with Sustainability. Frontiers in Energy Research. 2017. Available online: https://www.frontiersin.org/article/10.3389/fenrg.2017.00018 (accessed on 23 August 2021).
14. Wackernagel, M.; Rees, W.E. *Our Ecological Footprint: Reducing Human Impact on the Earth. Gabriola Island*; New Society Publishers: Gabriola Island, BC, Canada, 1996.
15. Hornsey, M.J.; Fielding, K.S.; McStay, R.; Reser, J.P.; Bradley, G.L.; Greenaway, K.H. Evidence for motivated control: Understanding the paradoxical link between threat and efficacy beliefs about climate change. *J. Environ. Psychol.* **2015**, *42*, 57–65. [CrossRef]
16. Rocheleau, D.E.; Steinberg, P.E.; Benjamin, P.A. Environment, development, crisis, and crusade: Ukambani, Kenya, 1890–1990. *World Dev.* **1995**, *23*, 1037–1051. [CrossRef]
17. Millennium Ecosystem Assessment. *Ecosystems and Human Well-Being: Synthesis*; Island Press: Washington, DC, USA, 2005.
18. Millennium Ecosystem Assessment. *Ecosystems and Human Well-Being: Current State and Trends*; Island Press: Washington, DC, USA, 2005.
19. Millennium Ecosystem Assessment. *Ecosystems and Human Well-Being: Scenarios*; Island Press: Washington, DC, USA, 2005.
20. Piketty, T. *Capital in the Twenty-First Century*; Harvard University Press: Cambridge, MA, USA, 2014.
21. Steffen, W.; Grinevald, J.; Crutzen, P.; McNeill, J. The Anthropocene: Conceptual and historical perspectives. *Phil. Trans. R. Soc. A* **2011**, *369*, 842–867. [CrossRef]
22. Laurent, E. Issues in environmental justice within the European Union. *Ecol. Econ.* **2011**, *70*, 1846–1853. [CrossRef]
23. Martinez-Alier, J. *The Environmentalismof the Poor: A Study of Ecological Conflicts and Valuation*; Edward Elgar Publishing: Cheltenham, UK, 2002.
24. Berthe, A.; Elie, L. Mechanisms explaining the impact of economic inequality on environmental deterioration. *Ecol. Econ.* **2015**, *116*, 191–200. [CrossRef]
25. Duflot, R.; Baumeister, S.; Burgas, D.; Kuparinen, A.; Potterf, M. Building up an ecologically sustainable and socially desirable post-COVID-19 future. *Sustain. Sci.* **2021**, *16*, 1397–1403. [CrossRef] [PubMed]
26. Wilkinson, R.; Pickett, K. *The Spirit Level: Why Equality is Better for Everyone*; Penguin Books: London, UK, 2010.
27. Heerink, N.; Mulatu, A.; Bulte, E. Income inequality and the environment: Aggregation bias in environmental Kuznets curves. *Ecol. Econ.* **2001**, *38*, 359–367. [CrossRef]
28. Fleurbaey, M.; Kartha, S.; Bolwig, S.; Chee, Y.L.; Chen, Y.; Corbera, E.; Lecocq, F.; Lutz, W.; Muylaert, M.S.; Norgaard, R.B.; et al. (Eds.) Climate Change 2014: Mitigation of Climate Change. In *Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2014.
29. Scruggs, L.A. Political and economic inequality and the environment. *Ecol. Econ.* **1998**, *26*, 259–275. [CrossRef]
30. Roca, J. Do individual preferences explain the Environmental Kuznets curve? *Ecol. Econ.* **2003**, *45*, 3–10. [CrossRef]
31. Roca, J.; Serrano, M. Income growth and atmospheric pollution in Spain: An input–output approach. *Ecol. Econ.* **2007**, *63*, 230–242. [CrossRef]
32. Bina, O.; La Camera, L. Promise and shortcomings of a green turn in recent policy responses to the "double crisis". *Ecol. Econ.* **2011**, *70*, 2308–2316. [CrossRef]
33. IPCC. 2021. Available online: https://www.un.org/climatechange?gclid=Cj0KCQjwkIGKBhCxARIsAINMioKf4$\times$0pSlvGn7rt_JzaxT0YAZLYmZzUPVHDbpopyg1GOgvdlqRzFiQaApnfEALw_wcB (accessed on 2 September 2021).
34. IPCC. Summary for policymakers. In *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*; Stocker, T.F., Qin, D., Plattner, G.-K., Tignor, M., Allen, S.K., Boschung, J., Nauels, A., Xia, Y., Bex, V., Midgley, P.M., Eds.; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2013.
35. Mora, C.; Frazier, A.G.; Longman, R.J.; Dacks, R.S.; Walton, M.M.; Tong, E.J. The projected timing of climate departure from recent variability. *Nature* **2013**, *502*, 183–187. [CrossRef] [PubMed]
36. Heath, Y.; Gifford, R. Free-market ideology and environmental degradation: The case of belief in global climate change. *Environ. Behav.* **2006**, *38*, 48–71. [CrossRef]
37. Kellstedt, P.M.; Zahran, S.; Vedlitz, A. Personal efficacy, the information environment, and attitudes toward global warming and climate change in the United States. *Risk Anal.* **2008**, *28*, 113–126. [CrossRef]
38. Milfont, T. The interplay between knowledge, perceived efficacy, and concern about global warming and climate change: A one-year longitudinal study. *Risk Anal.* **2012**, *32*, 1003–1020. [CrossRef]
39. Boin, A.; Hart, P.; Stern, E.; Sundelius, B. *The Politics of Crisis Management: Public Leadership Under Pressure*; Cambridge University Press: Cambridge, UK; New York, NY, USA, 2005.
40. Bouman, T.; Steg, L.; Dietz, T. Insights from early COVID-19 responses about promoting sustainable action. *Nat. Sustain.* **2021**, *4*, 194–200. [CrossRef]
41. Lo, A.Y. Analysis and Democracy: The Antecedents of the Deliberative Approach of Ecosystems Valuation. *Environ. Plan. C Gov. Policy* **2011**, *29*, 958–974. [CrossRef]
42. Stobbelaar, D.J.; Groot, J.C.J.; Bishop, C.; Hall, J.; Pretty, J. Internalization of agri-environmental policies and the role of institutions. *J. Environ. Manag.* **2009**, *90* (Suppl. 2), S175–S184. [CrossRef]

43. Lehmann, P.; Beck, S.; de Brito, M.M.; Strunz, S.; Thrän, D. Environmental sustainability post-covid-19: Scrutinizing popular hypotheses from a social science perspective. *Sustainability* **2021**, *13*, 8679. [CrossRef]
44. Mi, L.; Zhao, J.; Xu, T.; Qiao, Y.; Zhang, Z. How does COVID-19 emergency cognition influence public pro-environmental behavioral intentions? An affective event perspective. *Resour. Conserv. Recycl.* **2021**, *168*, 105467. [CrossRef]
45. DeMarco, P.M. Rachel Carson's environmental ethic—A guide for global systems decision making. *J. Clean. Prod.* **2017**, *140*, 127–133. [CrossRef]
46. Carson, R.; Darling, L.; Darling, L. *Silent Spring*; Houghton Mifflin Company & Riverside Press: Cambridge, MA, USA, 1962.
47. Ehrlich, P.R. *The Population Bomb*; Ballantine Books: New York, NY, USA, 1968.
48. Commoner, B. The relation between industrial and ecological systems. *J. Clean. Prod.* **1997**, *5*, 125–129. [CrossRef]
49. Commoner, B. The environmental cost of economic growth. In *Energy, Economic Growth, and The Environment*; RFF Press: Washington, DC, USA, 2013; Volume 7, pp. 30–66.
50. Meadows, D.H.; Meadows, D.L.; Randers, J.; Behrens, W.W., III. *Limits to Growth*; New American Library: New York, NY, USA, 1972.
51. Meadows, D.H.; Randers, J.; Meadows, D.L. The Future of Nature: Documents of Global Change. *Trans. R. Soc. S. Afr.* **2013**, *69*, 101–112.
52. Wilcox, B.A.; Gubler, D.J. Disease ecology and the global emergence of zoonotic pathogens. *Environ. Health Prev. Med.* **2005**, *10*, 263–272. [CrossRef]
53. di Marco, M.; Baker, M.L.; Daszak, P. Opinion: Sustainable development must account for pandemic risk. *Proc. Natl. Acad. Sci. USA* **2010**, *117*, 3888–3892. [CrossRef]
54. Keesing, F.; Belden, L.K.; Daszak, P. Impacts of biodiversity on the emergence and transmission of infectious diseases. *Nature* **2010**, *468*, 647–652. [CrossRef] [PubMed]
55. Gedžūne, G.; Gedžūne, I. Pre-service teachers' aesthetic learning about inclusion and exclusion. *Int. J. Sustain. High. Educ.* **2015**, *16*, 72–95. [CrossRef]
56. Henning, G.K. The guided hike in Banff National Park: A hermeneutical performance. *J. Sustain. Tour.* **2008**, *16*, 182–196. [CrossRef]
57. Hull, D.L.; Glenn, S.S. Multiply concurrent replication. *Behav. Brain Sci.* **2004**, *27*, 902–904. [CrossRef]
58. Schönpflug, U.; Bilz, L. The Transmission Process: Mechanisms and Contexts. In *Cultural Transmission: Psychological, Developmental, Social, and Methodological Aspects*; Culture and Psychology; Schönpflug, U., Ed.; Cambridge University Press: Cambridge, UK, 2008; pp. 212–239.
59. Graedel, T.E.; Allenby, B.R. *Industrial Ecology*; Prentice Hall: Upper Saddle River, NJ, USA, 1995.
60. Ayres, R.U. *Industrial Metabolism: Restructuring for Sustainable Development*; Ayres, R.U., Simonis, U.K., Eds.; United Nations UP: Tokyo, Japan, 1994; pp. 3–20.
61. Ayres, R.U. Industrial Metabolism: Theory and Policy. National Academy of Engineering. In *The Greening of Industrial Ecosystems*; The National Academies Press: Washington, DC, USA, 1994.
62. Lemille, A.; Schröder, P.; Desmond, P. Making the circular economy work for human development. *Resour. Conserv. Recycl.* **2020**, *156*, 104686.
63. Blomsma, F.; Brennan, G. The emergence of circular economy: A new framing around prolonging resource productivity. *J. Ind. Ecol.* **2017**, *21*, 603–614. [CrossRef]
64. Brones, F.; Carvalho, M.M. From 50 to 1: Integrating literature toward a systemic ecodesign model. *J. Clean. Prod.* **2015**, *96*, 44–57. [CrossRef]
65. Otero, I.; Farrell, K.N.; Pueyo, S. Biodiversity policy beyond economic growth. *Conserv. Lett.* **2020**, *13*, e12713. [CrossRef]
66. Jevons, W.S. *The Coal Question: An Inquiry Concerning the Progress of the Nation, and the Probable Exhaustion of Our Coal-Mines*; Flux, A.W., Ed.; A.M. Kelley: New York, NY, USA, 1965.
67. Ceddia, M.G.; Sedlacek SBardsley, N.O.; Gomez-y-Paloma, S. Sustainable agricultural intensification or Jevons paradox? *Role Public Gov. Trop. S. Am. Glob. Environ. Chang.* **2013**, *23*, 1052–1063. [CrossRef]
68. Velten, S.; Leventon, J.; Jager, N.; Newig, J. What is sustainable agriculture? A systematic review. *Sustainability* **2015**, *7*, 7833–7865. [CrossRef]
69. Nuss, P.; Günther, J.; Kosmol, J.; Müller, F.; Frerk, M. Monitoring framework for the use of natural resources in Germany. *Resour. Conserv. Recycl.* **2021**, *175*, 105858. [CrossRef]
70. York, R. Ecological Paradoxes: William Stanley Jevons and the Paperless Office. *Hum. Ecol. Rev.* **2006**, *13*, 143–147.
71. Alcott, B. Jevons' paradox. *Ecol. Econ.* **2005**, *54*, 9–21. [CrossRef]
72. Blatt, E.F.; Giannetti, B.F.; Agostinho, F.; Sevegnani, S.; Wang, Y.; Almeida, C. MVB Evaluating producers as resource consumers and alternative consumption patterns: Outcomes from emergy synthesis of the jeans supply chain. *Clean. Responsible Consum.* **2020**, *1*, 100002. [CrossRef]
73. Kuhn, T.S. *The Structure of Scientific Revolutions*, 1st ed.; University of Chicago Press: Chicago, IL, USA, 1962.
74. Frugoli, P.A.; Almeida, C.M.V.B.; Agostinho, F.; Giannetti, B.F.; Huisingh, D. Can measures of wellbeing and progress help societies to achieve sustainable development? *J. Clean. Prod.* **2015**, *90*, 370–380. [CrossRef]
75. Giannetti, B.F.; Agostinho, F.; Almeida, C.M.V.B.; Huisingh, D. A review of limitations of GDP and alternative indices to monitor human wellbeing and to manage ecosystem functionality. *J. Clean. Prod.* **2015**, *87*, 11–25. [CrossRef]

76. Giannetti, B.F.; Fonseca, T.; Almeida, C.M.V.B.; Oliveira, J.H.; Valenti, W.C.; Agostinho, F. Beyond a Sustainable Consumption Behavior: What Post-pandemic World Do We Want to Live in? *Front. Sustain.* **2021**, *2*, 635761. [CrossRef]
77. van den Bergh, J.C.J.M. Six policy perspectives on the future of a semi-circular economy. *Resour. Conserv. Recycl.* **2020**, *160*, 104898. [CrossRef]
78. Ura, K.; Galay, K. (Eds.) Gross National Happiness and Development. In *First International Seminar on Operationalization of Gross National Happiness*; The Centre for Bhutan Studies: Thimphu, Bhutan, 2004.
79. Daly, H. A further critique on growth economics. *Ecol. Econ.* **2013**, *88*, 20–24. [CrossRef]
80. Daly, H. A Steady-State Economy. UK Sustainable Development Commission. 2008. Available online: http://www.sd-commission.org.uk/publications.php?id=775 (accessed on 12 September 2015).
81. Robèrt, K.-H. Tools and concepts for sustainable development, how do they relate to a framework for sustainable development, and to each other? *J. Clean. Prod.* **2000**, *8*, 243–254. [CrossRef]
82. United Nations Environment Programme (UNEP, 2015). Available online: http://www.unep.org/greeneconomy/AboutGEI/WhatisGEI/tabid/29784/Default.aspx (accessed on 12 August 2021).
83. Giannetti, B.F.; Almeida, C.M.V.B.; Agostinho, F.; Sulis, F.; Coscieme, L.; Pulselli, F.M.; Bastianoni, S.; Marchettini, N. Enzo Tiezzi, turning pioneering into modern ideas: Tempos, Ecodynamics and sustainable economy. *Ecol. Model.* **2020**, *431*, 109162.
84. Geng, Y.; Sarkis, J.; Ulgiati, S.; Zhang, P. Measuring China's Circular Economy. *Science* **2013**, *339*, 1526–1527. [CrossRef]
85. Ghisellini, P.; Gaetano, P.; Viglia, S.; Gaworski, M.; Setti, M.; Ulgiati, S. Integrated Agricultural and Dairy Production within a Circular Economy Framework. A Comparison of Italian and Polish Farming Systems. *J. Environ. Account. Manag.* **2014**, *2*, 367–384. [CrossRef]
86. Mellino, S.; Gaetano, P.; Buonocore, E.; Angelis, G.; Liu, G.; Xu, L.; Ulgiati, S. Alternative Options for Sewage Sludge Treatment and Process Improvement Through Circular Patterns: LCA-based Case Study and Scenarios. *J. Environ. Account. Manag.* **2015**, *3*, 77–85. [CrossRef]
87. Baggio, G.; Qadir, M.; Smakhtin, V. Freshwater availability status across countries for human and ecosystem needs. *Sci. Total Environ.* **2021**, *792*, 148230. [CrossRef]
88. Von Liebig, J. *Die Grundsätze der Agricultur-Chemie: Mit Rücksicht auf Die in England Angestellten Untersuchungen*; F. Vieweg und Sohn: Braunschweig, Germany, 1855.
89. Giannetti, B.F.; Demétrio, J.F.C.; Bonilla, S.H.; Agostinho, F.; Almeida, C.M.V.B. Emergy diagnosis and reflections towards Brazilian sustainable development. *Energy Policy* **2013**, *63*, 1002–1012. [CrossRef]
90. Wilting, H.C.; Schipper, A.M.; Bakkenes, M.; Meijer, J.R.; Huijbregts, M.A.J. Quantifying Biodiversity Losses Due to Human Consumption: A Global-Scale Footprint Analysis. *Environ. Sci. Technol.* **2017**, *51*, 3298–3306. [CrossRef]
91. Isbell, F.; Tilman, D.; Polasky, S.; Loreau, M. The biodiversity-dependent ecosystem service debt. *Ecol. Lett.* **2015**, *18*, 119–134. [CrossRef] [PubMed]
92. Ascher, W. Coping with complexity and organizational interests in natural resource management. *Ecosystems* **2001**, *4*, 742–757. [CrossRef]
93. Fearnside, P.M. Estimation of human carrying capacity in rainforest áreas. *Trends Ecol. Evol.* **1990**, *5*, 192–196. [CrossRef]