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Sustainable Development Goal Drivers in Food Systems

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Interacting driving forces in food systems, resulting in cumulative driver effects and synergies, induce non-linear processes in multiple directions. This paper critically reviews the discourse on driving forces in food systems and argues that mindset is the primary predictor for food system outcomes. In the epoch of sustainable development goals (SDGs) and the Anthropocene, mindset matters more than ever. Transformative narratives are beginning to transcend the dominant social paradigm, which is still driving the food system's overall trajectory. The psychosocial portrayal of the systemic mindset found in organic food systems presented in this paper "flips the script" and hypothesizes that worldview and paradigm have the most causal linkages with unsustainable driver synergies and reversely the biggest leverage on the mitigation thereof. Borrowing from ecological economics discourses, the paper sharpens the driver definition by applying the DPSIR analytical tool as a modified diagnostic framework and modeling approach for food systems. This research sheds new light on the nature of drivers of change, which are often portrayed as almighty and inevitable trends shaping food systems. Instead, it is proposed that drivers emerge from the actors' mindset, affecting food system behavior in a non-linear way. Mindset drives reinforcing feedback loops, resulting in vicious and virtuous cycles. These driver motives manifest in subsystems and continue to drive their interaction across food system elements. Mindset acts as an encapsulated input of food systems, all the while responding to feedback and releasing new drivers. A transformation framework along leverage points of the food system is presented that features the concept of SDG drivers.

Keywords: mindset, paradigms, drivers, SDGs, transformation, feedback, synergies, emerging properties

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INTRODUCTION

Food systems are the enabling source for civilization; they are the root and nexus for variables such as climate change, social justice, food nutrition, and security as well as human health and the viability of ecosystems (Caron et al., 2018). Industrial–chemical farming methods, in conjunction with non-transparent and inequitable supply chains over long distances, have shown to cause severe degradation to the biospherical global commons as well as widening social inequities (Los Angeles Food Policy Council, 2013).

According to the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystems, unsustainable agribusiness is the paramount driver of land degradation across the planet, which is propelled by novel and unprecedented consumption patterns in an increasingly globalized economy. Land degradation in turn is a major contributor to climate change, and to make this

vicious cycle complete, climate change is anticipated as the principle driver of biodiversity loss (IPBES, 2018).

Food system transformation must involve a common understanding of development scenarios to be pursued, along with their potential outcomes and emerging properties. Caron et al. (2018) suggested that the sustainable development goals (SDGs) bear a new opportunity and momentum to elaborate the contributions of food systems toward the global commons. Food systems should regard themselves as powerful levers for transformation by orientating themselves toward the SDGs.

The problem, according to Müller and Sukhdev (2018), has to do with the prevailing economic logic and "productivity only" metrics in agri-food system assessments since the advent of the green revolution, which are reinforcing food systems that deny nature's contribution. According to Randers et al. (2018, p. 4), the challenge lies in the psychology of worldviews or mindset, insofar that "everybody knows, but nobody wants to understand" the magnitude of the transformation that is needed. According to Hirschnitz-Garbers et al. (2016), mindset has the most causal linkages with the unsustainable use of natural resources.

A new paradigm for our food future involves a mindset shift toward systems thinking in order to acknowledge agroecosystems as perhaps the planet's largest biome with the highest impact on nature's cycles. Because "all our actions aggregate and are interconnected with the global commons and the earth system," humankind needs to look beyond carbon and climate as the only mitigation currencies with the aim of operationalizing "a global commons framework for the stewardship of all food-related planetary boundaries" (Rockström et al., 2020, p. 5).

People, groups, and whole societies go on functioning by creating narratives that offer them a coherent picture of how the world works at a level of complexity that they can deal with. If something does not fit into this narrative or is simply too complex a story, the human psychology is not short of mechanisms to filter it out. The economist Paul Collier (2008) is convinced that a mindset shift is the only thing that can save humanity. He argues that the alliance of the two forces compassion and enlightened self-interest is a combination that can change the world for good. "We need compassion to get ourselves started and enlightened self interest to get ourselves serious" (Collier, 2008, TED Talk).

Global food system performance is closely linked with most, if not all, of the SDG (Chaudhary et al., 2018). In order to advance food system transformation toward SDG compliance, effective policies are required that coordinate actions by different public and private stakeholders, in order to navigate the interactions between material, behavioral, and other drivers of change such as urbanization, economic growth, climate change, information, and connectivity (Ruben et al., 2019).

The aim of this paper is to synthesize emerging food system theories regarding the need for transformative drivers, from both actor-centric and governance perspectives, framed by a mindset concept. A recent mixed methods study identified a universal motivational driver pattern among key actors of organic food systems, henceforth OFS, from around the world, irrespective of their socioeconomic differences. The resulting "organic mindset" established by this investigation revolves around an intuitively ethical agenda, demarcated by the following transformational responses when asked about their primary motivation for acting on behalf of OFS: (1) transformative learning and collective impact, (2) equitable growth and community empowerment, (3) resilient production and ecosystem services, and (4) moderate consumption and healthful lifestyle. The quality and specific constellation of these driver categories conform with the underpinnings of the SDG agenda (Kretschmer et al., 2021).

This paper critically reviews the discourse on driving forces in food systems and argues that mindset is the primary predictor for food system outcomes. This research sheds new light on the nature of drivers of change, which are often portrayed as almighty and inevitable trends shaping food systems. Instead, it is proposed that drivers emerge from the actors' mindset, affecting food system behavior in a non-linear way. The psychosocial portrayal of the OFS mindset presented in this paper "flips the script" and hypothesizes that worldview and paradigm have the most causal linkages with unsustainable driver synergies and reversely the biggest leverage on the mitigation thereof (Hirschnitz-Garbers et al., 2016).

This research wants to showcase how mindset qualities such as those found in OFS and their resulting driving forces are converging with the trajectories of both SDG and planetary boundaries agendas. The paper provides a juxtaposition and synthesis between the scientific community's emerging consensus of what transformative responses to food system threats and weaknesses should look like on the one hand and the kinds of responses and core tenets that are emblematic of OFS on the other hand. The synthesis of these two strands provides the basis for an SDG driver framework, illustrating the relationship between mindset and driving forces.

Furthermore, this paper makes the attempt to derive from transdisciplinary scientific discourses the inherent driving quality of sustainability and transformation narratives such as the ones embedded in the organic mindset. Ecologically sustainable behaviors and the corresponding environments are conducive for experiencing greater feelings of competence and happiness than what can be derived from engaging in technologically heavy and often environmentally degrading behaviors (Kasser, 2009). Numerous convergent scientific theories are suggesting that the human being is in fact "hardwired" for sustainable development (Ikerd, 2014; Ulluwishewa, 2014; Scharmer, 2016; James, 2017). This article wants to portray the innate capacity of the organic food and farming paradigm to liberate and align the human drive toward self-transcendence (Maslow, 1993) with the planetary need for regeneration, which intuitively merge in the pursuit of sustainable happiness (Dambrun, 2017) as an intrinsic OFS correlate (Kretschmer et al., 2021).

DRIVERS AND FEEDBACK IN FOOD SYSTEMS

Food system literature commonly defines the term driver or driving forces as a collective term for any consistent human-induced factor resulting in significant and durable outcomes and leading to material impacts (Béné et al., 2019). Typical lists of food system drivers revolve around the same categories

of climate change, consumption patterns, population growth, and technological innovation (Moragues-Faus et al., 2017). The premise of this paper conforms with this anthropogenic driver logic and expands it with a psycho-social definition from the European Environmental Agency who is regarding a driver as a basic need, such as "the need to be profitable and to produce at low costs" (Kristensen, 2004, p. 2).

Individual driver effects cause feedback, a process by which an initial impulse or driver flows through a cascading effect, ultimately to re-affect itself. Identifying a feedback loop is the first step to detect potential entry points for intervention, or policy levers. Food system drivers can be identified from the "dynamics of food system changes over time in relation to predefined societal, environmental or distributional goals" (Ruben et al., 2019, p. 2).

However, contrary to linear driver effects, cumulative driver effects in food systems entertain unforeseeable feedback loops that produce a host of consequences (Müller and Sukhdev, 2018). Interacting driving forces in food systems, resulting in cumulative driver effects and synergies, induce non-linear processes in multiple directions (Hirschnitz-Garbers et al., 2016).

Feedback loops work to synchronize the state of elements within complex adaptive systems. Negative feedback works to maintain a desynchronized set of states, causing differentiation, while aiming to correct or reduce deviations in the system's processes to reestablish a steady course back in the direction of the system's goals. Positive feedback changes or grows the system in ways that amplify and enhance the system's current processes (Creative Commons, 2015). Negative or balancing feedback loops in food systems can be observed for instance in the agricultural policy realm, such as the planned banning of the herbicide glyphosate, known as "Roundup" by the European Union by the end of 2023. Positive or reinforcing feedback is a phenomenon that can lead to negative or positive outcomes. It is often associated with negative synergies, such as the connection between increased monocultures and pest pressure, as well as increased homogeneity within the agro-sector and the phenomenon of supermarketization on the next level, leading to cheap calories and obesity, higher susceptibility to diseases, and so forth. Reinforcing feedback leading to positive outcomes on the other hand may take its starting point from a mindset level through the four principles of the International Federation of Organic Agriculture Movements (IFOAM) including health, ecology, fairness, and care (Luttikholt, 2007), which is reflected in pesticide-free stewardship practices committed to building soil fertility through compost and cover cropping, leading to more resilient cropping systems via mycorrhizal fungal networks and other symbiotic processes that foster agrobiodiversity and can have a mitigating effect on environmental degradation and climate change. This ecocentric mindset of wanting to emulate natural processes and to work with nature and not against it is also reflected on a relational level in OFS through values-based supply chains (Pugliese et al., 2015; Stotten et al., 2018).

When feedback loops are inhibited, a system can spin out of control. Such phenomena can be observed in food systems where humans derive economic benefits from natural capital without any expenditure to balance it, therefore enabling the system to develop in a one-sided direction. Over millennia, civilization and the economy have undergone a co-evolution with the natural environment, subjected like all other creatures to the same natural regulation and feedback loops within the biosphere. Human beings, however, through successive industrial and economic revolutions have created engineered environments with endogenous feedback loops and an implicit paradigm that has become largely delinked from the logic of the natural environment. For feedback loops to function properly, there needs to be a common metric of value in order to enable feedback to regulate the two systems in an integrated fashion (TEEB, 2018).

Social renewal and natural regeneration practices typically combined in OFS offer a pathway of returning to functional evenness in both ecosystems and human communities, leading to valuable but invisible sustainable and human development as well as non-marketed ecosystem services that are much higher compared with those generated by conventional systems (TEEB, 2018; Sanders and Heß, 2019).

While agro-industrial value chains are characterized with cold, often unfair, and anonymous relations, sort of delinking the food sector from social structures, alternative local food networks on the other hand have been associated with the notion of embeddedness, meaning close social relations, in order to characterize the opposition to the agro-industrial model. Local food networks have been portrayed as advancing trusting, authentic, fair, and more personal relationships (Chiffoleau et al., 2016).

Such an approach can be seen in the OFS Eco-Region program that originated in the Italian Bio-Distretto, where the resource relating to the place identity is reflected in the collective commitment and accompanying governance processes of food system stakeholders to promote organic farming and value chains (Stotten et al., 2018). This virtuous cycle leads to more coherence between the underlying mindset and the resulting actions within food systems (Pugliese et al., 2015) as well as the accumulation of social capital within the region. This will ultimately contribute to a shared identity and the synchronization of agents.

MINDSET AND ONTOLOGY—THE HIDDEN DRIVERS

Contemporary science views the Earth no longer "as a machine composed of elementary building blocks" but rather as an inseparable network of relationships (Capra and Luisi, 2014, p. 6). These authors contend that the biggest challenges of our time, such as environmental degradation, climate change, and economic disparity, cannot be understood in isolation but rather as conjunct systemic problems. The driving forces originating from a mindset of corporate capitalism are perpetuating the "clash between linear thinking and the non-linear patterns in our biosphere, the ecological networks and cycles that constitute the web of life" (Capra and Luisi, 2014, p. 56). Qualitative growth by contrast, so Capra concludes, is growth that enhances the quality of life through generation and regeneration.

Mindset and its inherent values constitute the core concept across all the social sciences, capable of harmonizing the diversity

of scientific interests regarding human behavior. Mindset is the main dependent variable in the study of personality, society, and culture and the core driver of social attitudes and behavior (Rokeach, 1973).

According to Wesley Schultz (2001), intrinsic values are based on perceived cognitive needs that can be distinguished into three arenas of concerns that are postulated to drive human behavior: egoistic, altruistic for others, and eco-altruistic for the biosphere. Research concerning the three value arenas has found pro-environmental behavior to be much higher in altruistic individuals. The social theory of the "growth mindset" vs. "fixed mindset" by Dweck (2008) is showing that outcomes in peoples' lives or in an entire organization will differ radically depending on the mindset, its paradigmatic orientation, and the kinds of narratives that are feeding it.

Different researchers have characterized essential value aspects using continuum scales that model the relationship between behavior and values. Descriptors used for such value scales typically represent polarized, paradigmatic views to characterize a person's idealized conception of values. Studies have found a correlation between paradigmatic worldviews and sustainable agricultural practices, linking environmental values with socially and environmentally beneficial practices (Lincoln and Ardoin, 2016).

The researchers Beus and Dunlap (1994) developed the "Alternative vs. Conventional Agricultural Paradigm Scale," a composite behavioral index that suggests a positive association between the production practices of farmers and their mindset. For the first time, this paradigm continuum provided empirical evidence that the way farmers view agriculture totally impacts the way they practice agriculture. Their research suggests that farmers whose paradigmatic orientation combines productivity with environmental protection and conservation are more likely to espouse agricultural practices that accomplish these same goals. In contrast, farmers who are unable to evolve are likely to be inadequately prepared for complex future challenges (Beus and Dunlap, 1994). Therefore, it would seem logical to seek the actual driving quality in food systems in the mindset of the actor.

The organic principles (see **Table 1**) not only are applied within the organic farming community but also transmit to all stakeholders within the value chain. In that sense, organic farming is, broadly speaking, not only a sustainable land-use system but due to its systemic approach by way of its core principles, "leads to enhanced happiness as well as an increased awareness about sustainable development" (Kretschmer et al., 2021, p. 8).

TABLE 1 | The four principles of organic agriculture by the IFOAM (Luttikholt, 2007).

Health	Organic agriculture should sustain and enhance the health of soil, plant, animal, human, and planet as one and indivisible.
Ecology	Organic agriculture should be based on living ecological systems and cycles, work with them, emulate them, and help sustain them.
Fairness	Organic agriculture should build on relationships that ensure fairness with regard to the common environment and life opportunities.
Care	Organic agriculture should be managed in a precautionary and responsible manner to protect the health and well-being of current and future generations and the environment.

IFOAM, International Federation of Organic Agriculture Movements.

FEEDBACK DRIVERS IN FOOD SYSTEMS

The food system nexus represents a highly composite and complex interface, made up of numerous mutually interacting subunits, whose repeated synergies engender collective behavior that informs the functioning of the individual parts via feedback loops (Rickles et al., 2007). There are real connections between the socio-ecological capital base in food systems on the one hand (environmental, human, social, and built capital bases) and the resulting flows that each class of capital produces on the other hand, including the consumption of goods and services. These flows assume a driving force, leading to durable outcomes and resulting in significant impacts. The four capital bases may be regarded system prerequisites or framework conditions. In order to conceive of the economics of ecosystems and biodiversity, or a common metric of value, these capital based drivers need to be estimated, along with the expenditure for safeguarding the capital stocks in order to deliver those flows in perpetuity (Müller and Sukhdev, 2018).

According to these authors, the different capital stocks of food systems "can be valued as the net present value of their future returns" (Müller and Sukhdev, 2018, p. 52). When driving forces that stem from these capital classes are misaligned, residual flows or feedback drivers result, which manifest in unintended consequences that can induce negative externalities in terms of their social, environmental, and ultimately economic impact on the food system. These residual flows along the eco-agrifood value chain are driving some of the most unsustainable impacts that affect the Earth support systems as well as the SDGs (Müller and Sukhdev, 2018).

OFS may be classified as alternative or local food systems consisting of various subsystems, including farms based on biodiversity and biological inputs engaged in values-based supply chains (Therond et al., 2017). Values-based supply chains differ in several ways from traditional supply chains. Values-based supply chains are based on values beyond the economic value, which are shared by all partners along the chain. The creation of social capital within the territory will contribute to a shared identity. Values-based supply chains aim for a long-term partnership among actors, while optimizing the value for all partners as well as for the customers, including fair profit margins, fair wages, and fair business agreements, thus supporting the rural economy (Stotten et al., 2018).

Mindset and cumulative feedback driver effects within food systems become system synergies, driving reinforcing feedback loops, including virtual and vicious cycles. Synergy may be described as the degree of effectiveness to the mutual endeavors between diverse subsystems working in concordance. Positive synergies are the outcome of the subsystems (i.e., food environment) and their components effectively attaining both integration and differentiation. Virtuous and vicious cycles are both events that are based in positive feedback loops, whereby

each loop of the cycle reinforces the initial cycle. A virtuous cycle generates sustainable outcomes, whereas a vicious cycle produces adverse consequences. A virtuous cycle basically is the combination of positive feedback combined with positive externalities. Feedback refers to dependencies based on the same actions, whereas externalities refer to dependencies between different actions (Creative Commons, 2015).

Mindset and the resulting outputs as well as existing feedback drivers manifest in all subsystems such as production or consumption and continue to drive their interaction across all food system elements within these subsystems. Feedback loops are vital to understanding the endogenous structures of food systems. According to Rickles et al. (2007), feedback in non-linear systems happens between integrative levels of organization, in both micro- and macro-regimes, in such a way that micro-level synergies between subsystems create patterns on the macro-level, which then feed back onto the subsystems, causing them to create a new pattern, which feeds back again and so forth. According to Brzezina et al. (2016), this implies that certain actors or components of a system gain dominance over others, at different times. Rickles et al. (2007, p. 3) called this "global to local" positive feedback co-evolution. The interdependent relationship between mindset and food system outcomes therefore suggests not only a "problem-determined system" (Ison et al., 1997, p. 267) but also due to the driving action of feedback also a "system-determined problem."

Hence, mindset acts as a sort of encapsulated input of food systems (see **Figure 1**). While the term "input" in agronomic terms typically refers to physical operating supplies, it may be warranted to expand its definition to a new meaning under the coupled human–natural food system logic. This paper argues that mindset, as composed of paradigms and narratives, may in fact be regarded as the nested input for the food system, representing a concentric feedback mechanism that responds to existing feedback drivers, while releasing new drivers at the same time. The mindset motives or paradigms manifest in food system elements and sub-systems. The types of resulting synergies depend on the quality of the sub-systems. The mindset responses lead to outputs, outcomes, and externalities, perpetuating the mindset or input paradigm.

Positive and negative synergies in food systems are both non-linear interactions generating combined outcomes that constitute either more or less effectiveness compared with the components viewed in isolation. Synergistic interactions give rise to integrative levels that are dependent upon the integrity of the synergies between their constituent parts. Sustainable macro-level shift can happen fast because of positive externalities, creating positive feedback that drives rapid change across the system. Integrative levels of organization or new macro-level regimes emerge when the system converges upon a new set of rules or protocols that drive all of the parts to adopt that new pattern (Creative Commons, 2015).

A CONCEPTUAL FRAMEWORK OF DRIVERS IN FOOD SYSTEMS

In order to visualize the central role that mindset plays in food systems and to sharpen the driver definition, a familiar diagnostic framework and modeling approach known from environmental economics shall be modified in order to suit a food systems context. According to its terminology, DPSIR stands for the Drivers–Pressures–States–Impact–Response conceptual framework, which has been used since 1995 by the European Environment Agency, among others. The Drivers, Pressures, States, Impact, and Response conceptual model is a

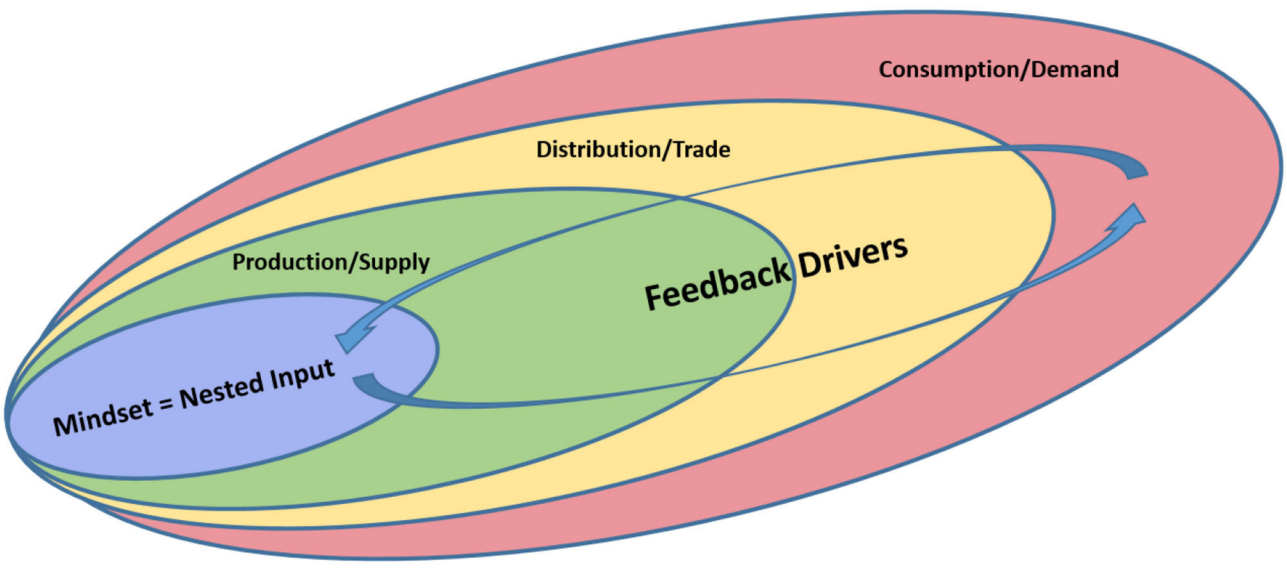

FIGURE 1 | Mindset as encapsulated, omnipresent input to food systems, manipulating leverage points and inextricably intertwined with feedback by determining its driving quality across the system.

causal framework, initially designed for policy actors to illustrate the interconnectedness between globalized society and the environment (Maxim et al., 2009).

The basic idea behind the DPSIR diagnostic framework (European Environmental Agency, 1999) is a negative feedback loop, which illustrates that a change in environmental States (S) leads to Impacts (I) on the ecosphere, society, and human health, which in turn evoke a societal or political Response (R) feeding back on Drivers (D), State, or Impacts through various mitigative or curative actions (Gabrielsen and Bosch, 2003).

In the DPSIR literature and under an ecosystem services logic, the category of Pressures, equated with outputs in this study, are also conceived of as anthropogenic elements prompting environmental change. Normally, these changes, such as environmental degradation, are perceived as negative and undesired, diminishing the benefits that humans get from the environment (Maxim et al., 2009).

The concept of State or state changes, equated with outcomes in this study, is defined as the probable or attained short- to medium-term effects of the outputs by an intervention. Outcomes describe quantity and quality of both natural and socioeconomic phenomena within human–natural coupled systems. Food systems generate multiple outcomes affecting in some way or another food security, natural capital, and social welfare (Ericksen, 2008).

Impacts, equated with externalities in this study, may be described as the consequences of outcomes (Gabrielsen and Bosch, 2003). Externalities may be positive or negative, intended or unintended, long-term effects that are directly or indirectly generated by a developmental intervention (Maas and Liket, 2003).

Responses, equated with mindset in this study, concern both actor-centric responses and political actions of mitigation with the aim of redirecting drivers, outputs, outcomes, and externalities. Responses necessarily infer mindset, since all human actions are inspired by specific values, norms, and conventions, reflecting one form of mindset or another. This study also regards mindset and drivers to essentially be one and the same thing, even though there can be a disconnect or cognitive dissonance between the two. As a balancing feedback loop, the original DPSIR model assumes "business as usual" economic driving forces that need to get "reined in" by appropriate regulating responses. It can however be interpreted as a form of cognitive dissonance too and clearly reflects an anthropocentric paradigm, when misaligned agricultural policies (=responses) leading to diverging outcomes constantly need new responses. This study advocates for responses and drivers to form a more coherent whole, reflected also in governance processes (see **Figure 2**), as can be observed in regional OFS where drivers and outcomes are more aligned with the governing mindset (Pugliese et al., 2015). Most literature sources consider Drivers, Driving Forces, or Drivers of Change as strictly anthropogenic factors. Driving Forces originate from food systems and other economic sectors triggering Pressures on ecosystems (Maxim et al., 2009).

The European Environmental Agency characterizes Driving Forces as "social, demographic and economic developments in societies and the corresponding changes in lifestyles, overall levels of consumption and production patterns" (European Environmental Agency, 1999, p. 8). Staying within this framework, Maxim et al. (2009) distinguished between "primary" and "secondary" driving forces. The authors describe primary driving forces as "technological and societal forces that motivate human activities" (Maxim et al., 2009 p. 13) such as individual needs, cultural attitudes, social structure, and population growth. These primary driving forces or human needs then give rise to developments that lead to secondary driving forces, which are human activities triggering outputs, outcomes, and externalities. Mindset therefore acts as a kind of interpreting or mediating entity between those perceived needs and how they become translated into food system activities (see **Figure 3**).

The Millennium Ecosystem Assessment (Reid, 2005) considers primary driving forces framework conditions or indirect drivers. Müller and Sukhdev described these framework conditions as food system capital bases (Müller and Sukhdev, 2018) with innate flows or drivers. This can be imagined as the innate capacity of the natural or human capital posing a potential—a drive, via their sheer existence, to be developed. Hence, food system capital bases and framework conditions provide primary driving forces, which then, depending on the choices and the mindset of actors, are turned into activities or output, which are considered secondary driving forces.

The response category within the DPSIR feedback model always reflects mindset and therefore intrinsic driver qualities, engendering both balancing and reinforcing feedback. Hence, for the purpose of adapting the DPSIR diagnostic framework to a food systems context, the response dimension is replaced by mindset as the primary input of the system, positioned at the beginning of the feedback loop. Proposed is a Mindset–Outputs–Outcomes–Externalities (M-O-O-E) feedback mechanism to adequately describe food system driver dynamics.

The mindset driver framework presented in this research is challenging the premise underpinning the discourse on food system drivers. Unlike the typical representation of, for instance, climate change as a driver within food systems, climate change may, according to the mindset logic portrayed in this paper, be regarded an externality and feedback driver (Müller and Sukhdev, 2018). The same holds true for the category of environmental degradation, commonly labeled a food system driver, which should be considered an externality or feedback driver, resulting, in part, from an unsustainable food system mindset and its unsustainable driver trajectory that has contributed to the problem in the first place.

Therefore, depending on the prevailing mindset and its paradigmatic orientation or interpretation of needs, different driver qualities emerge from the responding mindset. When food system actors interpret their needs under the so-called "dominant social paradigm" (DSP) (Dunlap and van Liere, 1984), rooted in the notion that human beings, unlike other living species, are exempt from the boundaries of constraints of nature, drivers of an entirely different nature are released compared with translating needs into action under what is called the "new environmental paradigm" (Dunlap and van Liere, 2008), which supports an ecocentric worldview. Primary driving forces assume

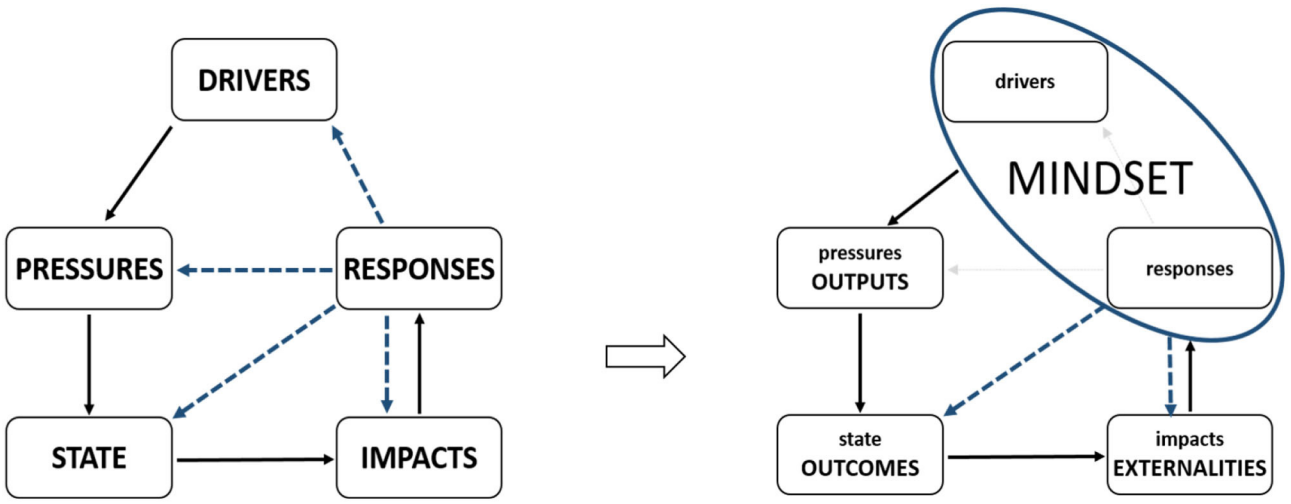

FIGURE 2 | Original vs. modified DPSIR framework.

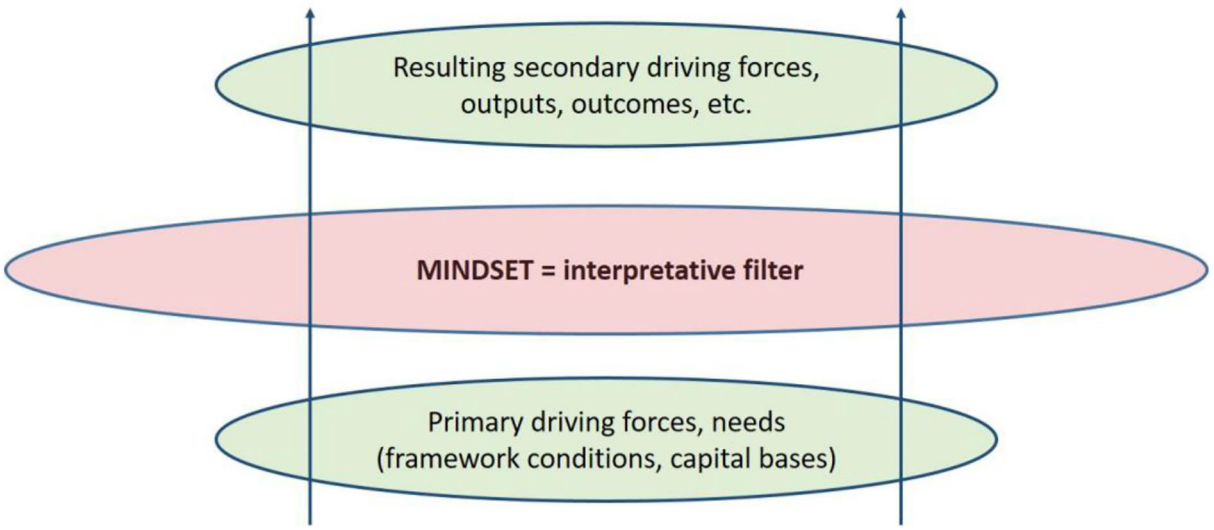

FIGURE 3 | Mindset as the mediating entity or interpretative filter between primary driving and secondary driving forces.

their particular driving force and find their implementation outlet (secondary driving forces) only once they are interpreted by the actor's mindset. All mindsets are triggered by what DPSIR literature calls primary driving forces or framework conditions (Nelson et al., 2006), but exactly how these needs are converted to secondary driving forces depends on mindset and the respective paradigms it adheres to.

The here proposed modified Mindset–Outputs–Outcomes–Externalities (M-O-O-E) framework proposes that mindset represents a kind of threshold of human behavior that will determine the quality of the resulting pressure and further causalities unleashed from the mindset driver. These driver motives manifest in subsystems and continue to drive their interaction across food system elements. The framework proposes that mindset and the associated actions may induce either sustainable or unsustainable consequences on the food system. Mindset is the filter through which needs are interpreted into response, action, and/or policy.

Drivers in food systems derive from mindset, intentionally or unintentionally. **Figure 4** illustrates how the big trends or framework conditions that are commonly labeled simply as drivers in food system literature (Béné et al., 2019) obviously concern all food system actors alike, but do not necessarily need to dictate their action. The individual items that are considered as drivers in food systems reflect the aggregated anthropogenic output, as filtered through the DSP. Many actors feel powerless in their response to those trends because of the path dependencies they find themselves in Müller and Sukhdev

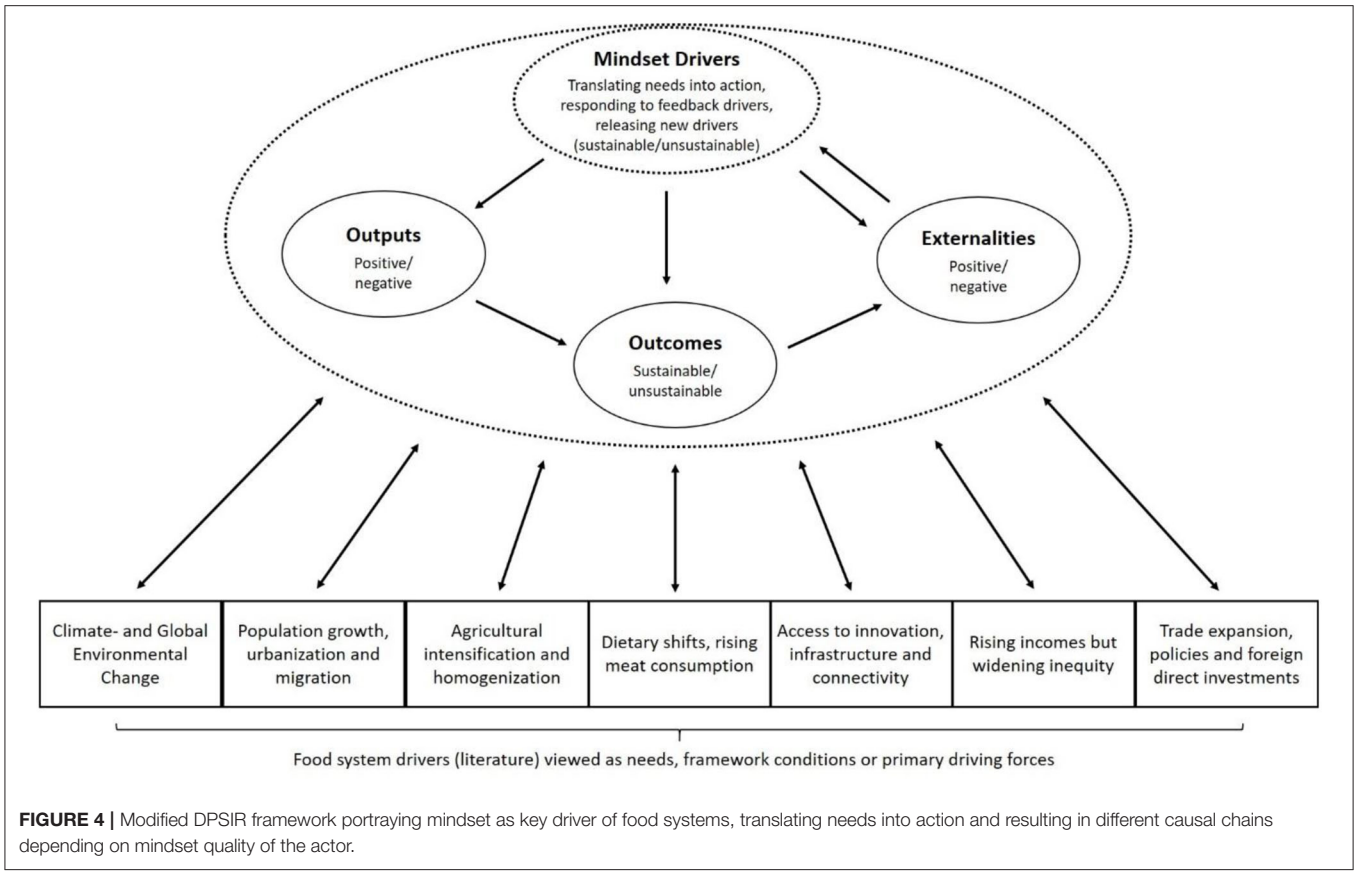

FIGURE 4 | Modified DPSIR framework portraying mindset as key driver of food systems, translating needs into action and resulting in different causal chains depending on mindset quality of the actor.

(2018). The paradigmatic orientation of individual actors' or an entire industry's mindset-mediated choices at this critical juncture make all the difference.

Mindset is the only response function in the system that can redirect this driving force into a more sustainable trajectory. The underlying driver conception presented in this paper is based on the theory of leverage points, which states that the hardest to achieve leverage point is the power to transcend paradigms (Meadows, 1999).

It is critical to understand the underlying paradigm or mindset that has brought forth those driver patterns to begin with. To consider something a framework condition or a legitimate need warrants the question of ontology or through what paradigm lens one is looking. This is especially relevant in these times of the coronavirus pandemic, during which the world finds itself at an inflection point that is conducive to accelerating the shift of multiple paradigms.

Certainly, under the DSP, it would be justified to consider environmental degradation as a legitimate need, but not under an ecocentric worldview. Under the new environmental paradigm, these supposed "needs" or framework conditions must be viewed as existing negative externalities derived from an unsustainable mindset that has created some of these so-called food system drivers. Therefore, when applying a mindset logic, these primary driving forces must be viewed as feedback drivers perpetuating mostly negative externalities, resulting from misaligned capital bases, which need urgent responses by food system actors.

The commonly listed driver categories, as displayed in the illustration above (**Figure 4**), may be understood partially as needs and partially as negative externalities under the mindset logic presented in this paper. These drivers affect all food system actors alike. The predominant neoliberal or "business as usual" paradigm in food systems has had its share in producing these drivers from the get-go. The question is how these drivers along with their path dependencies can be exnovated and redirected toward a future bearing trajectory via appropriate transformational responses. As Einstein's famous quote is concerned, one cannot solve a problem with the same mindset that has created it. A new sustainable food system mindset is needed that has a proactive outlook rather than a reactive outlook. All drivers bear the opportunity for different interpretations along the eco/ego paradigm scale. For example, the abovementioned category of "Dietary Shifts" (**Figure 4**) may be interpreted by food system actors proactively as increasing diet and health awareness or reactively as increased meat consumption. Likewise, the category "Agricultural Intensification and Homogenization" may be mindset-translated either proactively into sustainable intensification and appropriate standardization or reactively into continued monocropping and biodiversity decline. The driver "Access to Innovation, Infrastructure and Connectivity" also

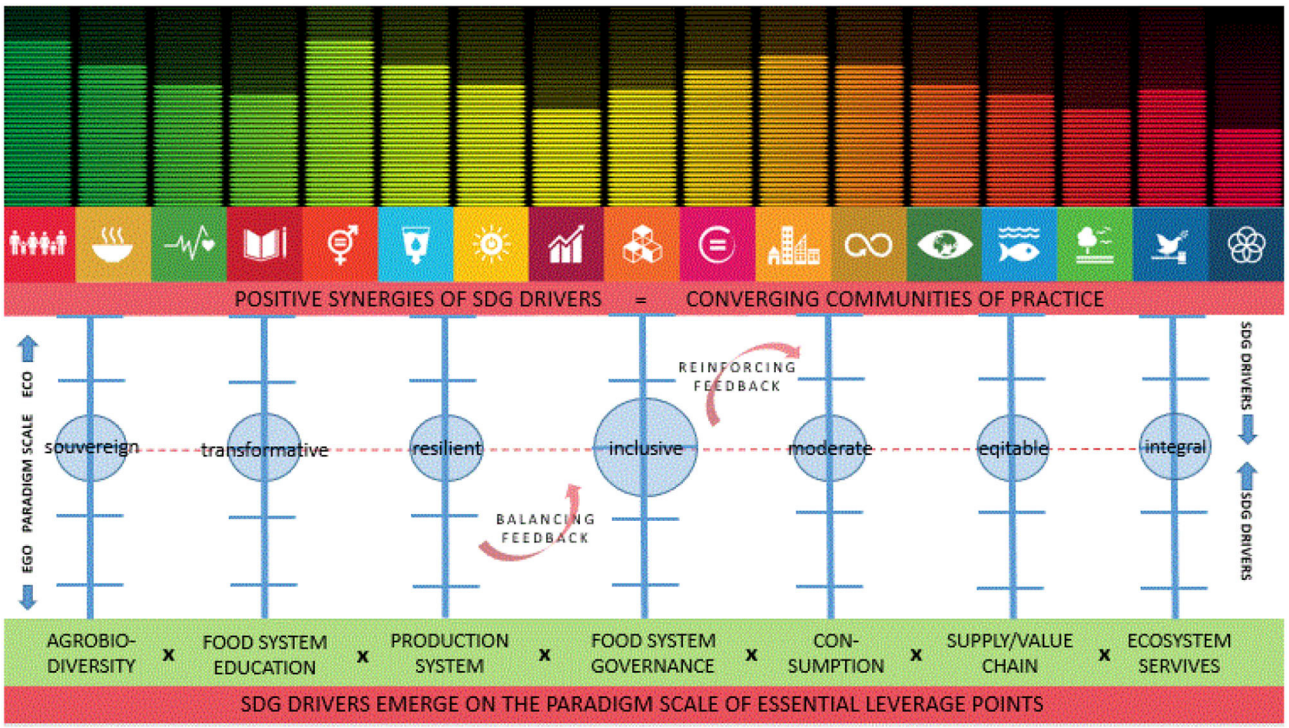

FIGURE 5 | Sustainable development goal (SDG) driver algorithm based on a mindset model. Aligned social, natural, and built capital stocks and flows leading to distributed positive externalities/emerging properties in food systems.

serves both productivist and sustainability paradigms along with their respective outputs.

THE DRIVING FORCE BEHIND SUSTAINABILITY

The following section presents examples of how the human mind actually seems made for sustainability and how its manifold expressions are conducive to drive human motivation. The current pandemic is holding up a mirror to humanity and making us realize that even though we live in a technotopian world, we are by no means technical beings but rather biologically vulnerable beings.

For well-established actors of particular food subsystems, their paradigm is so almighty that it tends to render the sheer possibility of an alternative as counterintuitive and implausible. Their conviction that their worldview conforms with reality itself tends to invalidate evidence that could cause the paradigm itself to collapse. The ensuing accumulation of unreconciled anomalies then is responsible for the eventual revolutionary overthrow of the incumbent paradigm, and its replacement by a new one (Kuhn and Hacking, 2012). A paradigm shift signifies the emergence of a new macro-level regime or integrative levels of organization, induced by a tipping point and critical mass when our interpretation of an ambiguous image undergoes a phase transition or "flips over" from one state to another.

The assumption that commitment to the "DSP" or to a technocentric worldview leads to a lack of concern for environmental quality has been tested (Dunlap and van Liere, 1984). An ecocentric mindset is the broadest notion of a worldview that sees intrinsic merit in all elements of the ecosphere, including their abiotic components. Technocentrism, on the contrary, acknowledges ecosystems and other life forms only insofar as they present a benefit to human well-being and self-interest. Decreasing the DSP-driven interpretation of the world in favor of positively attributed new ecological paradigm (NEP)-driven conception will soundly accomplish the SDGs (Putrawan, 2015).

Further indication that commitment to sustainability across all dimensions might in fact be the true driver of human evolution is provided by the later version of Maslow's hierarchy of needs (Maslow, 1993; Koltko-Rivera, 2006). In his revised version, Maslow paints a trajectory of a natural needs progression beginning with the need for safety, all the way to self-actualization, with the need for self-transcendence as the ultimate driver. This innate drive toward self-transcendence, as a personality trait that involves the overcoming of the limits of the individual self and the expansion of personal boundaries includes, potentially, the spiritual experience of considering oneself an integral part of the universe (Frankl, 1966).

The psychologist Ariel James (2017, p. 655) argued that "particular values become moral values to the extent that they conform to general principles of justice, fairness, and

responsibility." Additional qualities pertaining to moral responsibility include compassion and altruism. James hypothesized that the whole mind system is "circumscribed by a delimited set of normative moral principles" directly linked to values, attitudes, decisions, and actions (p. 657). Therefore, James continued that the so-called moral mind is actually the whole mind and that "implicit moral principles, premises, and assumptions cannot be isolated from social norms, conventional rules, cultural virtues, subjective emotions, and particular actions." Therefore, James refuted the contemporary paradigm of discontinuity between moral intuition and reflection. He concluded by claiming that "the moral mind is indivisible; there is only one mind, and it has a normative moral architecture" (James, 2017, p. 658).

Hence, a normative system such as the SDG framework may be considered a moral system since its operational agenda is supposed to solve "practical conflicts of justice, fairness, responsibility, and rights" (James, 2017, p. 652). The SDGs are said to be indivisible. They reflect a coherent mindset of compatible paradigms that pertain to the same macro-level regime of emergent ethical insight, which human beings seem to be hardwired for. A study on SDG interlinkages shows that the SDGs are an "integrated set of global priorities and objectives that are fundamentally interdependent" and by design, interacting with one another (Tosun, 2017, p. 2).

Further analysis found no fundamental incompatibilities between the goals (International Science Council, 2017). Therefore, the SDGs represent an integrated and indivisible agenda, namely, a network of goals, providing policy coherence because they impart a compatible array of objectives, pursuing both sustainable development and human development in a holistic approach.

THE MINDSET OF SUSTAINABLE FOOD SYSTEMS

The sustainable food system discourse is reaching a consensus regarding the redirection of two principal driving forces with the aim of planet and climate proofing food systems—a rescaling of production systems from industrial to sustainable and a "transformation of food system geography from regional specialization to regional diversity" (Lengnick et al., 2015, p. 573).

The following section showcases some snapshots from sustainable food system discourses that display positive/sustainable synergies, fostering sustainable development as an emerging property of underlying ecocentric mindset variations.

Local and subnational governments of a growing number of countries around the world are beginning to connect urban food dynamics with territorial development approaches, unleashing synergies among stakeholders by encouraging collective impact alliances between traditionally non-coherent policy arenas (UN Environment, 2019). Enabling rural–urban linkages, short supply chains, and green public procurement by fostering localized city–region food system approaches is therefore a key driver for the development of circular economies that promote equitable livelihoods.

Local food systems are increasingly modeled as conducive networks for sustainability, resilience, and equity by promoting community-driven socioeconomic development, human welfare, and environmental services (Ruben et al., 2019). The emergence of modern local food systems that sympathize with the social vision of "deep organic" also reveals a set of adaptive governance arrangements fostering a food system approach and transformative capacity that involve boundary-spanning structures, inclusiveness, and systemic problem framing (Termeer et al., 2018).

Transformative systems such as OFS can play an important role as drivers for imparting sustainability performance to mainstream systems, changing consumer demand and altogether raising the bar "of what is acceptable in farming in the 21st century" (Eyhorn et al., 2019, p. 255).

Lengnick et al. (2015, p. 573) projected that "transitioning to nationally integrated networks of sustainable metropolitan foodsheds" would result in improved climate resilience via enhanced agrobiodiversity, "modularity, and balanced accumulation of capital assets," which are key drivers associated with resilience in socio-ecological systems.

TRANSFORMATIONAL RESPONSES AND SUSTAINABLE DEVELOPMENT GOAL DRIVERS

Adaptive governance innovation and food system transitions in terms of enabling virtual cycles and coherence among food system key actors depend on the interaction of transformational responses. Development scenarios must be circumspect of driver interactions and path dependencies along the entire value chain, while building up the natural capital that underpins food systems. Sustainable food system trajectories must emphasize and actively promote regeneration that explicitly fosters ecosystem services and generate multiple positive externalities (TEEB, 2018).

Food system governance and its capacity to adapt to changing conditions are a central driver for sustainable development. By design, institutions within the context of food governance are disjointed across the divides of administrative jurisdictions, diverse normative frameworks, and public and private spheres. Agents of change are well-advised to emphasize that "food cannot be dealt with appropriately by the current fragmented institutional architecture" (C. Termeer et al., 2018, p. 2) and that food governance mechanisms ought to be harmonized, better integrated, and coordinated and made more coherent and inclusive (Candel, 2014).

According to Termeer et al. (2010), there arises a need for developing intermediate level institutions that coordinate the cross-scale interactions suitable for food system dynamics. The successful navigation of these cross-scale dynamics and operationalizing the SDGs can only be accomplished by multi-stakeholder and adaptive governance configurations (Ruben et al., 2019).

The evolutionary dynamics toward sustainability across all dimensions can be displayed particularly well when modeling food system outcomes based on governance paradigms. The evolution from conventional logic, to food system logic, to a multi-stakeholder governance paradigm applied on system leverage points such as value chain shows the transformational driver effect of inclusive governance regimes. Identifying leverage points and blending multi-level and multi-stakeholder dynamics may help to facilitate coherent strategies that generate enduring improvements in food systems' performance (Ruben et al., 2019).

Consensus is emerging also about the guiding principle of positive driver interactions, as a result of multisectoral governance mechanisms to enable resilient, integrated, sustainable, and inclusive food systems. The following section lists examples of transformational food system responses leading to optimal SDG outcomes. Similar to the concept of "essential variables" as minimum sets of variables required to characterize system change (Reyers et al., 2017), transformational drivers or SDG drivers need to be at the nexus of many processes, able to release a system from an undesirable trajectory, link to system transformations, and support the transformative agenda of the SDGs. This is based on the concept that it is realistic to identify key processes and determinants influencing outcomes within complex systems (Ericksen, 2008).

Calls for food system transformation pivot around the same main goals that are driving full spectrum SDG performance along the entire food value chain. For one, food systems should provide healthy and nutritious food for all. Food systems should also facilitate regenerative farming methods and equitable value chains. Thirdly, they should actively foster social and environmental resilience and mitigate climate change. Fourth, they ought to engender the revitalization of rural territories (Caron et al., 2018). This set of transformative responses to remedy food system externalities conveys a sense of coherence as it stems from the kind of "growth mindset" that has been put into practice by OFS around the world.

The FAO (2018) proposes a related set of five transformational driver principles, that is, (1) value addition, (2) resource protection, (3) equitable growth, (4) resilience, and (5) adaptive governance, that unleash positive interaction synergies or feedback drivers, resulting in full scope SDG achievement as an emerging property.

The UN's Urban Food Agenda (FAO, 2019) has identified four cross-cutting principles as transformation drivers. They include (1) resilience and sustainability, (2) social inclusion and equity, (3) rural–urban synergies, and (4) food system interconnectedness. Such algorithmic arrays of essential variables, expected to lead to sustainable cumulative driver effects, therefore creating virtuous cycles, showcase the power of paradigm and the natural compatibility of ethically driven governance mechanisms implemented in the food system.

Gustafson et al. (2016) proposed the following seven metrics of sustainable nutrition security as part of a novel monitoring and evaluation framework to quantitatively assess SDG performance of national food systems along essential transformation variables: (1) food nutrient adequacy; (2) ecosystem stability; (3) food affordability and availability; (4) sociocultural well-being; (5) food safety; (6) resilience; and (7) waste and loss reduction.

Ruben et al. (2019) identified three response areas regarding major transformational drivers, which jointly characterize the adaptation capacity of food systems, (1) sustainability, (2) inclusiveness, and (3) resilience capacity, which are not bound to particular nodes in the food value chain but instead facilitate the interlinkages and feedback within the nested subsystems of the value chain. This modeling approach takes the drivers urbanization, economic growth, climate change, and connectivity and subjects them to the transformational responses resilience, inclusiveness, and sustainability. An unchecked development and trajectory of these drivers under a default scenario would normally be assumed to steer toward unsustainable development, but this particular set of responses that are also deeply anchored within the principles of OFS is redirecting the development toward favorable outcomes.

For a food system to endure within changing environments, it has to be able to engender adequate responses to social, environmental, or economic perturbations, which means choosing from a diverse range of endogenous states or strategies in order to maintain and generate a critical degree of variety. Applying the law of "requisite variety" to food systems would imply that the sum total of states or its variety that the system's response mechanisms are capable of attaining must be greater than or equal to the number of states in the system being controlled (Ashby, 1991).

According to Brzezina et al. (2016), food systems have endogenous drivers that explain causes originating from the internal structure, while exogenous drivers can trigger the system to display certain behaviors, depending on the conceptualization of system feedback loops. Following this logic, the constellation of system elements then, along with the implicit mindset, which induces feedback loops, determines the resilience of the system and make it more or less prone to display negative behavior. Resilience in this context is defined by the three systemic notions of (1) robustness, or the aim to resist disruption to desired outcomes; (2) recovery, or the ability to bounce back after disruption; and (3) transformation, combining sustainability, and robustness via interventions such as food system education/awareness programs (Ingram, 2017).

The recently identified threats affecting food systems by Moragues-Faus et al. (2017) provide justification regarding such transformational responses as are being discussed here. The authors point out the following weaknesses of food systems: (1) environment and agriculture, mainly reflected by the loss of biodiversity and soil fertility; (2) policy and governance, mainly reflected by a lack of perspective and unequal power relations across the food chain; and (3) socioeconomic trends, mainly reflected by social exclusion, corporate interests, and changing consumption patterns. These observed perils of the food system conversely justify social and environmental norms fueling transformative responses in the form of SDG drivers illustrated below.

The illustration below (**Figure 5**) proposes a theory of change based on mindset and along the "ego- to eco" paradigm continuum. The idea of a fusion or functional

interdependence between the opposing mindsets of productivism and sustainability, however, might create a possible alternative worldview, harmonizing the respective technocentric and ecocentric paradigms (Corral-Verdugo et al., 2008). In this vein, SDG performance in food systems may be inspired by a combination of balancing feedback within unsustainable arenas of the food system and reinforcing feedback within sustainable arenas of the food system, both of which leading to positive externalities.

This SDG equalizer offers a unifying vision, empowering food system actors, including policymakers and educators to rely on ethically inspired, common sense maxims in order to achieve valuable outcomes, which will prove to become competitive advantages in future food systems (Tefft et al., 2017). The transformational responses needed to release unethical driving forces from their chaotic course resound with all human beings, irrespective of education or income levels. Systems thinking and its inherent plausible narratives can change perspectives and foster a food system mindset that will release cumulative transformational driver effects enabling communities of practice.

The SDGs, as illustrated in the transformational driver framework, are an emergent property, driven by aligned capital bases and narratives of enlightened self-interest. In other words, sustainability cannot be found in individual elements or dimensions; sustainability only emerges from wholes (Ikerd, 2014).

ORGANIC FOOD SYSTEMS AS BASINS OF ATTRACTION

Positive feedback works to synchronize the different states between elements as it creates an attractor. An attractor is a set of states or a behavior pattern to which a system naturally gravitates and returns to under stress. The particular pattern a network of any kind settles into is called its attractor. Attractors emerge from the interaction of system components and new behavior patterns (Golenia et al., 2017). Attractors in complex systems create their own basin of attraction or attractor network, which is the initial set of conditions or behavioral pattern enabling equilibrium or long-term behavior, which the system will remain cycling through unless perturbed. Therefore, the qualitative behavior of the long-time motion of a given system can be fundamentally different depending on which basin of attraction the initial condition lies in Ott (2006).

OFS may be visualized as gravitational basins generating an attractive force able to accelerate and drive the development of a territory (Pugliese et al., 2015). Increasingly, OFS serve as dense networks of best practices that transcend political boundaries, showing a commitment to the "think global, act local" paradigm, which believes in shared, aggregated know-how as a global common that everyone can capitalize on.

Positive synergies produce outcomes more valuable than the sum of their constituent parts because of the system's actors working together constructively. SDG achievements in food systems are outcomes of many distributed synergies and driver interactions of a food system operating effectively. It is the quality of synergies and feedback drivers that enable sustainable food systems such as OFS to generate positive systemic externalities. This paper pursues the hypothesis that drivers prevailing in OFS provide a kind of roadmap for the Agenda 2030 by serving as a catalyst for multiple sustainable development impulses and general ecoliteracy. The systemic OFS mindset produces a specific subset of drivers that lies at the heart of transformation processes.

The zero-sum game of our current food system is a direct effect of the negative synergies that its elements, subsystems, and their actors are producing. The outcome therefore is counterproductive and detrimental to all due to the negative externalities that are affecting the global commons as well as the social fabric of civilization. The emergent levels of such a system, mostly driven by negative synergies, produce macro-level regimes that themselves produce even more powerful unintended consequences. The reinforcing feedback drivers of such negative synergies have not been fully accounted for, due to the lack of more comprehensive and holistic assessment criteria up until now. With a lens and overall problem framing focused on misguided food security or yield per hectare narratives, the powerful negative externalities will continue to be overlooked, as humans are sleepwalking into a catastrophe (Norton, 2016).

CONCLUSION

In summary, it can be noted that the organic mindset and OFS around the globe have long embraced the notion of transformational responses to major trends because of mindset qualities that intuitively converge with global sustainability agendas, long before these were named as such. As a change agent, OFS have promoted and demonstrated resilience capacity, inclusiveness, and sustainability as integral constituents of their "DNA."

Integrating the theories of evolutionary dynamics by Darwin, Wilson and Scharmer along with Maslow's theory of self-transcendence, with Capra's understanding of deep ecology, the hope arises that food system paradigms and their driving forces may eventually align upon a common sustainability trajectory. While convergence toward a global sustainability mindset is still straying, there is strong indication that OFS are displaying a high adaptation speed toward future targets. Formerly regarded a transformative milieu, OFS now emerge as Clean Development Mechanisms, leveraging other vital concepts such as the circular economy or the urban–rural nexus.

OFS drivers lie at the heart of transformation processes as they follow an inherent SDG trajectory, serving as a catalyst for ecosystem services as well as sustainable and human development. The theory of change presented here suggests that there are valuable mindset qualities to be found in OFS that need to be nurtured so that they may unleash their transformative capacity as a new food system paradigm.

It would therefore be advisable to invest in both awareness campaigning and educational programming for localized food systems with a strong focus on the OFS narrative as a viable transformational driver. If food systems are to move toward more sustainable behavior in the future, ecological knowledge must be ensured to inform the wider context of the social ecosystems in which agriculture is practiced. This will safeguard a

better understanding of, and more influence over how ecological innovation will change our world. While current food and nutrition insecurity is a social issue, the perpetuation of yield per hectare narratives will have devastating impacts on ecosystems if the ecological integrity of agricultural systems is not maintained.

This research seeks to convey the complexity and incommensurability between different paradigms and mindsets. Assuming there is an evolutionary dynamic that is driving human consciousness, one may rephrase Martin Luther King's famous quote to something like the following: "the arch of the moral universe is long, but it bends toward justice …. and sustainability."

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author/s.

AUTHOR CONTRIBUTIONS

All authors listed have made a substantial, direct and intellectual contribution to the work, and approved it for publication.

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