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NORMATIVE COHERENCE AND ANTIFRAGILITY FOR THE SAFE AND JUST SPACE: A NEW PATHWAY TO CRISIS RESPONSE AND SUSTAINABILITY

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As I was revising for one last time my thesis, I remembered that despite the turns, shifts, and intricated paths I have followed so far in my academic ventures, I always kept in my heart the love and gratitude for nature, this kept me going all the time…

This dissertation is dedicated to the mountains, the rivers, and all the nature that surrounded me since I was a child, may I have the fortune to always be able to preserve, enjoy and contemplate them…

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Chapter 1. Introduction

In recent years, several global crises have emerged simultaneously: the COVID-19 pandemic, an unprecedented temperature rise, meteorological events such as floods, droughts, and heat waves, and a series of regime changes and armed conflicts that threaten democracy and wellbeing worldwide. The coexistence of these diverse and intertwined crises has marked the XXI century, bringing many new and old challenges (Barchielli et al., 2022). The COVID-19 pandemic brought back questions on how the dominant economic system characterized by growth strategies, and the development models that derive from it, affect humanity's capacity to face unexpected and large-scale events, defined as shocks. Numerous observers, such as Sachs, (2015) contend that we must rethink the objectives of development and the processes by which we achieve them in order to forge alternative pathways for the prevention, mitigation, and response to future social-ecological challenges.

Proposed by Kate Raworth in 2012, the doughnut model responds to this call as it is an alternative way of conceptualizing sustainable development. The model juxtaposes the establishment of an environmental ceiling with the construction of a social foundation (figure 1). The environmental ceiling consists of nine planetary boundaries, as set out by Rockström et al., (2009), beyond which lie unacceptable environmental degradation and potential tipping points in Earth systems. The twelve dimensions of the social foundation are based on minimum social standards, as established in the Sustainable Development Goals in 2015. Between social and

planetary boundaries lies an environmentally safe and socially just space in which humanity can thrive. The safe and just space is the operating area in which social equity exists while the earth's systems are preserved. By proposing this, Raworth advocates for a balance between economic development needed to ensure social equity and natural resources mobilization, and Earth's preservation. I propose the safe and just space, as an ideal model that advocates for strong sustainability, since it recognizes that human societies rely on vital earth systems, cycles, and processes and by ensuring their permanence, is ensuring our well-being and transcendence on this planet. The safe and just space recognizes the complex interlinkages between natural and human systems, which is the core idea of social-ecological systems.

The Doughnut of social and planetary boundaries (2017)

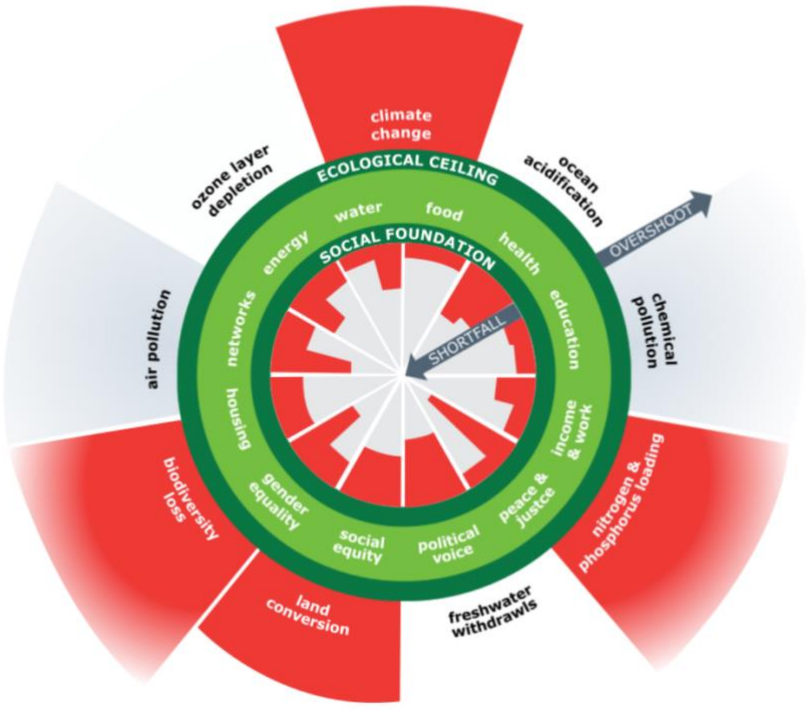


Figure 1. The safe and just operating space for humanity proposed by Raworth (source: Raworth, 2017).

This dissertation examines development within the framework of social-ecological systems. Ostrom (2007) defined them as coupled human nature systems with interlinkages and dynamic relations occurring inside them (Ostrom 2007). This perspective is very important because it acknowledges the interdependence and complex ties between nature processes and human societies: what happens in nature affects human communities and on the other hand, any anthropogenic phenomenon alters nature. This has led to a better understanding of the world and an improved capacity to respond to any of the crises aforementioned in a comprehensive way.

The safe and just space proposed by Raworth, and the social-ecological systems (SES) approach in general, are responses to the growing evidence that the above-mentioned changes in earth cycles are due to human activities, as shown by the IPCC report (Pörtner et al., 2022). Human activities have caused perturbations on essential planetary processes that are so profound that we have reached a planetary tipping point, and crossed planetary boundaries, affecting those processes in which human societies flourish (López-Corona et al., 2019). Therefore, there is an urgent need to accept responsibility and accountability which implies looking for innovative solutions to current social-ecological challenges and recognizing how they are interrelated. One notable example of how human activities led to interrelated crises is the COVID-19 pandemic. Its appearance was proven to be related to climate change, as studies about the intersection between the pandemic and climate

change showed: reduced habitat and environment degradation set the scenario for these zoonotic diseases. Ecosystems naturally act as disease and plague controllers and regulators, as they restrain diseases transmitted by fauna (zoonotic diseases). Anthropogenic-driven degradation and its effects such as climate change led to the release of these types of diseases (Jowell & Barry, 2020). This a clear example of how crossing a planetary boundary led to a worldwide health crisis.

The safe and just space is a step towards addressing the interlinked causes of the crisis as it shows how social equity must be ensured in order to prevent the degradation and perturbation of vital processes. Conversely, as long as there is an environmental crisis, humanity stands no chance of reaching equity. Interactions between ecological degradation and climate change threaten to exacerbate social and economic inequality globally (Díaz et al., 2019; United Nations Environment Programme, 2021). For example, risks of flooding, amongst other risks, are not equally distributed across socioeconomic and demographic groups. Income and wealth are major determinants of households' ability to respond to and recover from flooding. Such households tend to have limited access to transportation, lower savings rates, and less or inexistent insurance coverage and they are often further disadvantaged by deficiencies in materials used to build their homes (Baker et al., 2011). Engaging with social equity and nature conservation, the safe and just space model is a normative ideal type that enables the goal of "leaving no one behind," not even nature, which is the normative objective of the 2015 declaration of sustainable development goals.

Research question

This dissertation adopts the safe and just space as a normative objective in order to reinforce social-ecological systems and consequently, reduce social and environmental vulnerability. One originality of this research is a proposed conceptual approach for the attainment of the safe and just space. The dissertation proposes a Policy Coherence for Sustainable Development approach as a mechanism to define public policy and orient it toward the safe and just space. This approach highlights how different policy strategies can either undermine or enable the safe and just space depending on their content. The dissertation also examines policy implementation through the lens of antifragility. This analysis of social-ecological governance identifies specific characteristics of policy implementation that represent "policy learning" which is necessary for the orientation of policy frameworks toward the safe and just space. Specifically, this research studies implementation within the context of policy communities as it examines government, policy entrepreneurs, and individuals which represent stakeholders in social-ecological governance. The dissertation studies the reactions of these three groups of stakeholders to external shocks. Through this combined analytical approach, I propose a new conceptual and methodological framework identified as Normative Coherence for the Safe and Just Space (NCSJS) which is then applied to empirical research in southern Mexico.

This dissertation aims to respond to the following research question: How can social-ecological systems balance the need for social equity, economic development, and environmental conservation necessary for the achievement of a safe and just space? Specific questions include: how coherent are public policies with a safe and just space (Raworth, 2017) in the coffee-producing regions of

Veracruz? And do stakeholders at different levels respond in an antifragile way to shocks in agricultural systems?

Through the aforementioned approach, this dissertation addresses three bodies of scholarship that are prominent in sustainable development discussions: resilience, antifragility, and policy coherence for development. It engages with the ongoing discussions about the role of resilience in sustainable development; it posits antifragility as an alternative approach that goes beyond resilience; and finally, it addresses policy coherence for development as the mechanism that enables sustainable development objectives. Resilience serves as the point of departure for this study as it has emerged as a paradigm that is often cited by academics and policymakers as a framework that can respond to interlinked crises.

Dissertation structure

This dissertation is structured around seven chapters. Following this introduction, chapter two presents the literature review on resilience, antifragility, and policy coherence for development, positioning this study and doing a brief assessment of the state of the art. Chapter three is the conceptual framework for this study. It explains “normative coherence and antifragility for a safe and just space” which is a proposed originality of this research. Raworth’s safe and just space is presented as the normative objective of this study which looks to balance respect for environmental limits with the need to promote social equity for the reasons explained above. To achieve this objective, the study promotes policy coherence for development as a mechanism for the recognition/establishment of the safe and just space in terms of policy definition. The chapter then presents antifragility as a

mechanism for re-orienting policy implementation towards the establishment of a safe and just space. Within their respective fields, policy coherence and normative coherence for development and antifragility are often viewed as policy frameworks themselves. One proposed originality of this dissertation is the re-orientation of these concepts and instruments of policy frameworks for the attainment of a sustainable development objective, namely the safe and just space.

Following this explanation of the conceptual approach, chapter four presents the operationalization of Policy Coherence and Antifragility for a Safe and Just Space and the Methodological Innovations. Chapter five presents empirical research on normative coherence for a safe and just space. This chapter analyzes two State development plans in Veracruz, Mexico. These plans are important because they guide development policy at the state level in the case study territory (see below). The analysis presented here investigates their coherence with the safe and just space as defined by Raworth. Analyzing these two State Development plans is relevant because this study compares coherence before and after a shock in order to indicate the presence or absence of adaptation/policy learning. This analysis is followed in chapter six by an empirical study of antifragility for a safe and just space. This chapter examines policy implementation and the actions of stakeholders in the study territory which either detract from or contribute to policy learning. Finally, chapter seven presents the dissertation's conclusions.

The methodology for this dissertation is explained below. Specific methods of data analysis are presented in the introduction to the relevant empirical cases. The central Veracruz coffee-producing region is introduced below as the case study for

this research. The following section identifies and defines key terms which appear throughout this work.

Key terms

Vulnerability

For the purpose of this research vulnerability will be defined as the interaction between social inequity, and exposure to hazard. It is a transversal and socially constructed condition. A vulnerable system is one in which there is social inequity and an overshoot of the planet's capacity to sustain life -which creates or increases the hazard and affects exposures to it (Viner et al., 2020).

In this regard, social equity is how much commitment exists to expand the common good and minimize social divisions. I revisit the idea of justice and the capabilities framework of Amartya Sen's (2000) approach. Since development is presumably the goal of democratic societies, democratic governments should express this goal through public policies, by framing development as the pursuit of citizen freedom: political freedom, economic services, social opportunities, transparency opportunities, and protecting security.

Hazard

The potential occurrence of a physical event (including human-induced ones) that may cause human losses, damage to health, infrastructure, service provision, livelihoods, ecosystems, and environmental resources (IPCC, 2018 in Barchielli et al., 2022)

Risk

For the purpose of this research, I adopt the “disaster risk” approach to define risk: an objective peril that is always mediated through social and cultural processes (Oliver-Smith and Hoffman 1999 in (Wisner et al., 1994)). It results from the interaction between vulnerability, hazard, and exposure (Viner et al., 2020).

Shock

In this dissertation, shocks are perturbations that are characterized by a peak pressure that is beyond the normal range of variability in which the system operates (B. L. Turner et al., 2003), they are infrequent, sudden and generally unpredictable events (Salvia & Quaranta, 2015 in González-Quintero & Avila-Foucat, 2019) that tend to start intensely and have dramatic effects (Marschke & Berkes, 2006 in González-Quintero & Avila-Foucat, 2019)”.

Crisis

For the purpose of this dissertation, a crisis is an event that can produce high levels of damage and shatter our norms and ways of working. Crisis can reside at different levels (e.g., personal, organizational, ecological, and societal) and the level of damage they produce is higher than the level of damage that would be produced by “normal” conditions (Boin et al., 2016).

Stressor

For the purpose of this study, a stressor is a factor that has an adverse impact on a system's component(s) or process(es) affecting its/their functioning and threatening the system's survival (Alexander, 1999).

Resilience

In this dissertation, resilience will be defined as the capacity to absorb and respond to a disturbance while maintaining its essential structure and functions (Holling 1973, Folke et al. 2002). In this sense, resilience implies keeping the system the same. As mentioned before, a system can be resilient but still not antifragile.

Antifragility

For the purpose of this study and based on Taleb's original definition (2017) antifragility is the ability to benefit from changes caused by shocks and crises and thrive and continue growing.

Policy Coherence for Sustainable Development

In this dissertation, Policy Coherence for Sustainable Development is defined as a mechanism to integrate the dimensions of sustainable development throughout domestic and international policymaking (Organisation for Economic Co-operation and Development, 2016).

Normative Coherence for Sustainable Development is "the alignment of development instruments and frameworks with key sustainability norms as an

evaluation tool aimed at promoting transformative sustainable development" (Häbel, 2020).

Chapter 2. Literature review and state of art

Literature review on resilience

The concept of resilience has been identified as a response to crises in different academic disciplines. This literature review is based on qualitative methods. The goal was to revise the various definitions of social-ecological resilience to identify the main characteristics that constitute it. To conduct this review, I first, scanned academic journal databases, including Google Scholar & Scopus for the key search term "social-ecological resilience." To build a definition of social-ecological resilience that is closer to the common understanding of stakeholders involved in resilience frameworks and development, as well as practitioners specialized in resilience building, measurement, and theorization, the review included academic papers, articles, and reports, proposals, policy frameworks and action plans coming from NGOs, international agencies and practitioners.

Second, through the Scopus search engine, I selected the 20 most cited articles which included this term. At the same time, using Google search, I identified

resilience literature reviews and resilience framework reviews. A discriminative snowball sampling technique was employed, starting with the reviews and seminal articles on social-ecological resilience: Holling (1973) and Walker et al. (2002, 2004) to uncover new sources while rejecting those that were not aligned with the research topic (Denzin and Lincoln, 2005).

In total, 45 works from different disciplinary areas and development arenas were reviewed. An exclusion criterion was developed, and papers were retained that had an explicit focus on approaches for conceptualizing, measuring, operationalizing, and evaluating resilience from areas of academia and practice within the paradigm of social-ecological systems and sustainable development. The conceptual description of the field is presented below.

From ecology to intervention: the resilience paradigm

Resilience has first been described in ecological theory as: “a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables” (Holling, 1973). Holling’s definition centered on the persistence of relationships within a system, where they maintain a steady state or equilibrium. The system avoids crossing a threshold into a potentially new and irreversible state (Holling, 1973). The shorter the time to return to the original equilibrium, the more resilient a system is (Bollettino et al., 2017).

Although Holling’s definition was purely ecological, since then, the resilience concept has provided a “conceptual umbrella under which different disciplines can

come together to tackle complex problems with more holistic interventions”(Levine, 2014). By offering a way to understand how human and natural systems cope with shocks, resilience has been spread to other fields outside ecology as it stated the basis for wider definitions including the social systems interacting with natural ecosystems. The concept of shocks is central to the definition of resilience: shocks are perturbations that are characterized by a peak pressure that is beyond the normal range of variability in which the system operates (B. L. Turner et al., 2003), they are infrequent, sudden and generally unpredictable events (Salvia & Quaranta, 2015) that tend to start intensely and have dramatic effects (Marschke & Berkes, 2006).

Since early on its original conception, resilience perspectives started influencing fields outside ecology, leading to various resilience concepts such as culture as an equilibrium-based system, biological diversity in ecological economics (Perrings et al., 1992), non-linear dynamics and the modeling of complex systems of humans and nature (Costanza et al., 1993). The paradigm is prominent in environmental psychology (Lamson, 1986), cultural theory (Thompson et al., 1990) human geography (Zimmerer, 1994), the management literature (King, 1995), property rights and common property research (Feeny et al., 1996) and also other social sciences (Folke, 2006b). Understandings of resilience also broadened to reflect a greater appreciation that living systems are dynamic and continually developing, that and global systems are changing in ways and speeds that were not aware of.

Resilience has leveraged awareness about the close linkages between human and natural systems. As Folke (2006) has stressed in the title of his article “Resilience: The emergence of a perspective on social-ecological systems”, Holling’s seminal paper has become the theoretical foundation for the work with active adaptive ecosystem management and subsequent studies in a process that developed an integrative sense bringing together policymakers and scientists for creating explanatory models and suggestive policies in the late ’70s and then in the late ’80s (as noted in Holling and Chambers, 1973; Holling, 1973). Later, this led to the integration of complex system theory (Rapport et al., 1985; Steedman and Regier, 1987; Baskerville, 1988; Edwards and Regier, 1990; Robinson et al., 1990; Kay, 1991; Kay et al., 1999 in Folke, 2006), social learning (Clark & Dickinson, 2001) and ecological economics, to mention some, fields (Folke, 2006).

Throughout its conceptual history, resilience has been used both as a research and theoretical framework and as an action/management framework. According to the review of 35 resilience measurement frameworks made by Bahadur (2016), resilience is used to evaluate, diagnose and plan. Deriving from its popularity and widespread usage, definitions of resilience vary but there’s a consensus that resilience should enable systems to function and flourish in the face of shocks and stressors -a factors that have an adverse impact on a system’s component(s) or process(es) affecting its/their functioning and threatening the system’s survival (Alexander, 1999; Bahadur, 2016a).

The theoretical approach has mainly developed from Holling’s definition of resilience, in which a group of concepts was brought to the field of ecology: adaptive

cycle, panarchy, resilience itself, and transformability. According to this approach, the adaptive cycle consists of four phases: 1) growth or exploitation (r), conservation (K), collapse or release (omega), and reorganization (alpha). The first phase is characterized by readily available resources, the accumulation of structure, and high resilience. The second phase is thus one in which net growth slows and the system becomes increasingly interconnected, less flexible, and more vulnerable to external disturbances. These two phases, r to K, called the fore loop, correspond to ecological succession in ecosystems and constitute a development mode in organizations and societies. Disturbances lead to the next phase, a period of bound-up resources (omega) in which the accumulated structure collapses, followed by a reorganization (a) phase, in which novelty can take hold, leading eventually to another growth phase in a new cycle. In this phase, scholars have emphasized the existence of “windows of opportunities” (Folke et al., 2006).

The idea of panarchy was first stated by Gunderson and Holling, (2002): Social-ecological systems -understood as coupled human nature systems with interlinkages and dynamic relations occurring inside them (Ostrom, 2009)- have structures and functions that cover wide ranges of spatial and temporal scales. Structures and processes are also linked across scales. These interactions can be characterized as hierarchical or panarchical. Panarchical relations suggest that both top-down and bottom-up interactions occur (Gunderson and Holling 2002). This led to the conceptualization of social-ecological systems as complex adaptive systems. Complex adaptive systems are generally characterized by self-organization without system-level intent or centralized control. However, because human actions

dominate social-ecological systems, the adaptability of such systems is mainly a function of the individuals and groups managing them. Their actions influence resilience, either intentionally or unintentionally (Berkes et al., 2002). Their capacity to manage resilience intentionally determines whether they can successfully avoid crossing into an undesirable system regime or succeed in crossing into a desirable one (Folke et al., 2006).

Transformability is the capacity to create a fundamentally new system when the existing system is untenable (Walker et al. 2004). Social-ecological systems can sometimes get trapped in very resilient but undesirable regimes. Escaping from such regimes may require large external disruptions or internal reformations to bring about change (Holling and Gunderson 2002). The transformation of a social-ecological system can be in response to the recognition of the failure of past policies and actions, triggered by a resource crisis, or driven by shifts in social values (Gunderson et al. 1995).

Resilience as a theory has set the basis for a growing body of assessments trying to understand the mechanisms and processes for resilience, as well as a guiding principle for interventions in social-ecological systems. As Folke et al. (2002) mentioned, resilience is an approach that presents a perspective for guiding and organizing thought which provides a valuable context for the analysis of social-ecological systems, an area of explorative research under rapid development with policy implications for sustainable development (Folke et al., 2002). Limiting damage from disturbances and recovering from shocks features prominently across definitions. Managing change is core to most definitions, though some frameworks

extend this to include transformative shifts (Bahadur, 2016). Resilience measures include food security systems resilience, adaptation after natural disasters, rural livelihood resilience, city resilience, community resilience, hydric resilience, resilience against climate change, and social-ecological systems resilience.

The most prominent and widely used definitions were the ones from the Stockholm Resilience Centre, Walker (2004), Cumming and Peterson (2017). The Stockholm Resilience Centre defines this concept as “the capacity of a system, be it an individual, a forest, a city or an economy, to deal with change and continue to develop” (Moberg & Simonsen, 2013, p.). This follows very closely “the capacity of a system to absorb disturbance and reorganize while undergoing change to still retain essentially the same function, structure, identity, and feedbacks” (Walker et al., 2004). More comprehensively, the Resilience Alliance defines resilience as: “the capacity of a social-ecological system to absorb or withstand perturbations and other stressors such that the system remains within the same regime, essentially maintaining its structure and functions. It describes the degree to which the system is capable of self-organization, learning and adaptation” (Resilience Alliance, n.d.). Continuous development and transformation are important features in some of the resilience definitions. Folke (2006) states that resilience is about “how to persist through continuous development in the face of change and how to innovate and transform into new more desirable configurations” (Folke, 2006a, p. 260).

This literature review has identified key aspects of resilience as it is defined concerning SES. On the conceptual side, resilience implies both persistence and change. The persistence of specific configurations that give part to functions and

maintain structures enables the desirable performance of the system. It remarks that nonetheless, systems should change to adapt to the new conditions outside the system, specifically, configurations must change. In this sense, it is difficult to determine to what extent the systems should change (the amount of change) to sustain their functions and at the same time be able to cope with perturbations. As the body of resilience studies grows, seven generic principles for enhancing social-ecological resilience have resulted: maintain diversity and redundancy of species, landscape types, stakeholders, and institutions, manage connectivity of resources, species, and people, manage slow variables and feedbacks, foster complex adaptive system (CAS) thinking, encourage learning by acquiring new information skills or understanding, broaden participation by engagement of stakeholders and promote polycentric governance systems -a less centralized type of governance- a complex form of governance with multiple centers of decision making, each of which operates with some degree of autonomy (E. Ostrom, 2005; V. Ostrom, Tiebout, & Warren, 1961 in Carlisle & Gruby, 2019)-. Diversity and redundancy enhance resilience since elements respond differently to change and different elements can compensate for one another functionally. Connectivity provides links to sources of information and social cohesion after the change. Understanding the role of slow variables -such as land use and soil properties- helps to put in place appropriate governance structures to avoid shifts by diminishing feedbacks. CAS thinking stimulates practitioners to acknowledge interdependence and uncertainty in management approaches. Learning via partnerships with scientists and stakeholders who learn together how to create and maintain sustainable systems gives the possibility of designing more efficient and adequate management

strategies. Broad participation, which includes individuals in communities allows them to understand and make the needed connections to make decisions and self-organize to manage the social-ecological systems and strengthen resilience (Biggs et al. 2015 (Sterk et al., 2017). Finally, polycentric governance, as a multilevel governance structure, allows for a better adaptation to social and environmental change and it gives a good institutional fit for complex natural resource systems (Carlisle and Gruby, 2019).

On the other hand, in the methodological and intervention models, it is very clear that the focus is on preparing the systems to deal with future perturbations, limit the damage and manage the change. This is somehow difficult to operationalize if we remember that resilience implies self-organization. It has been proposed then that, strategies should tend to give actors within these systems the capacity to auto-organize themselves, to be more autonomous, and therefore be able to react promptly when crises arise. On the other hand, I found that resilience is framed differently according to the study unit/system of interest and the shock, these elements determine the measurement indicators and specific characteristics addressed, (Bahadur & Overseas Development Institute, 2016; González-Quintero & Avila-Foucat, 2019) which creates confusion. This confusion is due to the lack of definition of the focal “system” resulting from wanting different articulated problems to address and different mental models of real-world systems (Carpenter et al. 2005). Another source of confusion is the role of people in the system of interest: for example, a fisheries system or an agroforestry system. People are seen as exogenous factors of systems when the interest is on the ecological processes,

which in the case of the fisheries will be in the fish population dynamics and they are exogenous when attention focuses on the social-ecological interface, in an agroforestry system like a coffee plantation, the biodiversity managed by coffee producers as a source of income and part of their livelihood but also a source of ecosystem services of climate regulation and water production, for example; when the focus is on social dynamics then the ecosystem is the exogenous variable, as it is described in studies focused on resilience to storms, floods or droughts (Walker et al., 2012). Even though most of the resilience intervention frameworks propose actions to improve access to basic services and the fulfillment of the basic needs of the targeted communities, very little attention is paid to the structural causes that led to vulnerabilities and to the political context in which they occur. With some exceptions, such as OXFAM's intervention frameworks, resilience interventions haven't questioned why and which roles, functions, or elements of the system should be sustained. Social justice, for example, is not frequently highlighted to improve how communities and individuals face shocks such as meteorological phenomena, which is one popular objective of strategies for resilience. Lack of attention to the why and what should be maintained in the systems of interest since the goal of being resilient is to return to the previous state of the system, without investigating what made it react in a non-desirable way to a shock.

It must also be noted that resilience has been a key concept to tackle diverse social, ecological, and economic challenges since it has been very successful as a "bridging object". Resilience has brought to the table a multiplicity of stakeholders. It has been the basis for different intervention frameworks aiming to improve

livelihood conditions, governance, natural resource, risk, and vulnerability management. Resilience has been an “easy to grasp” concept due to its innovative spirit and comprehensive nature (Cavanagh, 2016). Resilience has been so attractive for both academics and policymakers because of “the imagery of steadfastness, of resoluteness, and of sturdiness that the concept evokes in conventional usage within contemporary governments and development institutions provides many with reassurance” (Cavanagh, 2016, p. 2). Resilience is a concept that is challenging and at the same time promising and exciting. Resilience states that despite its complexity, our world can be understood by “dividing” it first into components, elements, and linkages between them. In this sense, it builds a model to interpret what we can call reality, and it does so in a very pragmatic way. As mentioned by the OECD, performing a resilience analysis “provides a shared understanding of power dynamics, and how the use or misuse of power helps or hinders people’s access to the assets they need to cope with shocks”, nevertheless, this understanding is rarely included in the literature reviewed and in the practitioners’ reports (OECD, 2016, p. 2).

I think that, even though resilience is a useful framework that has re-stated the need to account for the complexity of the processes that occur in SES so interventions and assessments can lead to an improvement of the system to better cope with shocks, it can fall short of its objectives (see Tidball et al., 2018). As part of SES, humans affect feedbacks in social-ecological systems, leading to regime shifts. These changes alter an ecosystem’s capacity to deliver services on which human well-being relies. Social and ecological system dynamics are inextricably

linked. These linkages can cause humans and institutions to interact with ecological dynamics in ways that make the system vulnerable. In other cases, they can reinforce the resilience of an already undesirable state. These have been recognized in the resilience literature as social-ecological traps (Kretzenbacher, 2003) which have not been addressed sufficiently in the field. Interaction between social and ecological feedbacks can lead the system to social-ecological traps, locking the system into unsustainable pathways (Daw et al., 2012). As some authors such as Filotas et al. and Putz and Chattarai (2013 in Equihua Zamora et al., 2019) note unwanted feedbacks with detrimental consequences. For instance, illegal logging in Borneo can be seen as a self-organizing phenomenon supported by interactions among actors at all levels in the stakeholder hierarchy (Putz & Chattaraj, 2013). The feedback starts with pit sawyers taking out logs and pirate loggers taking advantage of governance failures. Coupled with unscrupulous timber buyers and corruption in government allowing the laundering of illegal wood has a great impact. Therefore, the illegal logging “system” is self-organized in a persistent way. Similarly, experience in Mexico suggests that corruption might be the common link in practically all-important ecosystem degradation processes (Equihua Zamora et. al, 2019), that are continually sustained because of self-organization. Similarly, Cavanagh criticizes how contemporary theories of social-ecological resilience do not satisfactorily account for how class formation and fragmentation under contemporary forms of capitalism effectively produce inequalities of exposure and vulnerability to environmental change processes (Cavanagh, 2017). Approaches that aim for a deep change in the damaging interactions haven’t been sufficiently discussed in the resilience field.

This dissertation contends that resilience is a good starting point to improve the conditions and responses to perturbations and shocks of SES. However, the concept of resilience can potentially mislead the understanding of the process in which SES can change to improve its functioning and overlook shocks as disruptive events that can lead to positive changes.

Due to these conceptual shortcomings, variants of resilience have emerged in the academic literature. For example, antifragility perspectives have been proposed in order to show how shocks can actually reinforce social-ecological systems. Antifragility goes beyond resilience by openly stating that shocks enable desirable changes in systems because these systems can and should build new ones. I argue that SES must change substantially, and in this sense, paradigms need to be changed. This dissertation aims to challenge resilience constructively: systems experiencing shocks must change since the configuration and structures before the shocks did not enable them to cope with the shock and were contributing to its fragility. In this regard, antifragility is viewed as an improved feature in a system's performance after resilience (Johnson & Gheorghe, 2013; Blečić & Cecchini, 2019; de Bruijn et al., 2020).

Literature review on antifragility

The literature review on antifragility was conducted through the Google scholar search engine using the keywords: “allintitle: antifragility governance OR ecological OR policy OR social OR systems OR government OR planning OR ecosystem OR organization” restricting the search to articles only. This showed 28 results in total. After reading the titles and abstracts the selection was reduced to 17. The main goal

of the literature review was to look at different definitions and uses of antifragility on topics closely related to policy coherence, governance, and social-ecological systems, in order to build the theoretical framework and its operationalization, this logic guided the selection of the keywords used for the search. The main reference cited in this field is Taleb's 2014 book entitled *Antifragile: things that gain from disorder (incerto)*.

All the definitions mentioned in the literature that was consulted referred to Taleb's definition. The uses of antifragility were various: healthcare learning assessment framework, rebels' strategies and tactical behavior in armed conflicts, urban planning, city infrastructure design criteria, organizational skills measurement, and framework for sustainability. Definitions of antifragility varied significantly. Tokalic et al., (2021) defined this concept as "the capacity of a system to produce a response that leads to more benefit than harm". They also mention that is a permanent benefit in response to change, and it is built on human effort. Omeni, (2021), citing Taleb & Douady, (2013) defines antifragility as 'positive sensitivity' to environmental pressure as an antifragile system does not capitulate under pressure, nor is it merely resilient to external stressors. Instead, it thrives under pressure and even requires pressure to expand, demonstrating "a convex response to a stressor or source of harm. Blečić and Cecchini (2020), based on Taleb, define antifragile systems as those that "can from time – from events, perturbations, stressors, volatility, disorder – also gain, get stronger, improve, evolve and adapt better". For Notarstefano, (2022), an antifragile strategy is, therefore, one that focuses efforts on reducing internal vulnerabilities (weaknesses). A definition cited by Equihua and colleagues (2019) enhances the idea of antifragility as going further than resilience:

“If a system is viewed as resilient, it is generally perceived as remaining within specified bounds, probably close to the optimal operational points” (Sidle et al., 2013, p. 9201). In there, the authors set again the question of which should be the variables under the “bounded ecosystem” and how to determine the range of values to consider the ecosystem as resilient.

Aligned with what Taleb proposed in his 2014’s book, three articles talk about a continuum of fragility that ranges from fragile, to robust, to resilient and finally antifragile (Johnson & Gheorghe, 2013; Blečić & Cecchini, 2019a; de Bruijn et al., 2020de Bruijn et al., 2020). Fragile is defined as degrading with stress which can cause the whole system (or its characteristics) to fail (Allen & Hoekstra, 2015) remains unchanged by stress (Johnson & Gheorghe, 2013), perturbations do not affect it, they leave it as it is (Blecic & Cecchini, 2020). Resilient is when the system is capable of quickly returning to its intended or non-failure state after a stressor hits it (Kjeldsen and Rosbjerg 2004; Johnson & Gheorghe, 2013; Laprie, 2008); the system can absorb, bounce back and recover from perturbations (Blecic & Cecchini, 2020).

Botjes et al., 2021 in their comprehensive analytical review of the antifragility of organizations provide a list of twenty-two antifragility attributes, focusing more specifically on organizations, such as business corporations. These attributes are top-down command and control, micro-management, redundancy, modularity, loosely coupled, diversity, non-monotonicity, emergence, self-organization, insert low-level stress, network connections, fail fast, resources to invest, Seneca’s barbell, insert randomness, reduce naive intervention, skin in the game, personal mastery, shared mental models, building shared vision, team learning, and systems thinking.

I will briefly describe the attributes that are relevant in social-ecological systems and allow or counteract the existence of a safe and just space.

Top-down command and control apply when an employee does not have the freedom to decide, having to follow instructions from the organizational hierarchy. Top-down command and control refer to the need of following a procedure to solve problems, something useful in emergencies. Nevertheless, I find that in the particular case of complex systems such as social-ecological systems, top-down command, and control can prevent the participation of community stakeholders, risking proposing solutions that respond only to the interests of some of the stakeholders. Redundancy is about using duplication to have not a single point of failure. Redundancy is mentioned and described similarly in social-ecological resilience literature. Keeping redundancy of specific structures and elements in SES can prevent a collapse of the system by compensation (Biggs et al., 2015), but at the same time, it can imply an inefficient use of resources and energy when it comes to institutions that are redundant. Diversity is the ability to solve a problem in more than one way with different components. And optionality, the availability of options, is a specialization of diversity. Both diversity and optionality resemble the concept of diversity in terms of social-ecological resilience and are complementary: diversity in problem-solving and availability of options promotes biodiversity preservation in social-ecological systems, strengthens livelihoods, and keeps a heterogeneous and diverse stakeholders' community (Davoudi et al., 2012; Sterk et al., 2017). Non-monotonicity is learning from bad experiences: mistakes and failures can lead to new information and data. As this becomes available it defeats previous thinking, which can result in new practices and approaches. Self-organization is a process

where some form of overall order arises from local interactions between parts of an initially disordered system. Self-organization is a highly mentioned element of social-ecological resilience as well, as it promotes autonomy in problem-solving (Sterk et al., 2017). Low-level stress insertion continuously into a learning system leads to continuous improvement. This will keep the system sharp all the time. This concept comes from the original notion of hormesis mentioned by Taleb: small and limited doses of venom can stimulate, for example, the optimal functioning of the human body (Taleb, 2012). Low-level stress insertion should be implemented only in very specific cases in which the possible downside effects do not imply human and natural losses nor contribute to or increase vulnerability and weaknesses in the system (Cavanagh, 2016). Mental models are deeply ingrained assumptions, generalizations, or even pictures of images that influence how we understand the world and how we take action. Building shared vision - a practice of unearthing shared pictures of the future that foster genuine commitment and enrollment rather than compliance. Acknowledging the complexity of coupled natural human systems and understanding the links and feedbacks between nature processes and human actions, is a bridging mental model that advocates for the safe and just space. Team learning starts with ’dialogue’, the capacity of members of a team to suspend assumptions and enter into genuine ’thinking together’. In terms of my antifragility framework, the basic principles of some of these attributes are included such as diversity, non-monotonicity, and systems thinking.

Living systems can and must do much more than merely react to the environment’s variability through random mutations followed by selection; some data has proven that they have built-in characteristics that enable them to discover

surrounding variations and cope with adversity, variability, and uncertainty. An example of this is what epigenetics have shown: DNA variations that regulate genes. These changes can be fostered by environmental conditions (Feil & Fraga, 2012). This environmentally driven epigenetic variation can be a genomic response to a stressful and unpredictable environment (Feinberg & Irizarry, 2010 in Rey et al., 2020). Antifragility is one, maybe the core of these characteristics (Danchin, Binder & Noria, 2011; Taleb, 2012). In fact, in a recent work (de Bruijn et al., 2020), it has been shown that the outcome of using antifragility as a design criterion is that the scheme being studied demonstrates a more favorable behavior than a "simple" robust or resilient model in a setting that is susceptible to black swans (unpredictable, very low frequency of occurrence but very high impact events).

This literature review highlights the main similarities and differences between resilience and antifragility. Both of these concepts focus on the presence of shocks/stressors/crises in global affairs. They both contend that these crises affect social-ecological systems significantly. Where they differ is their perception of how crises affect SES. Resilience, views shocks as negative forces, even as threats to the existence of social-ecological systems. Antifragility, instead, contends that shocks can have positive impacts on SES by forcing them to adapt in such a way that systems, and the stakeholders within them, must reinforce themselves. This perspective has acquired renewed urgency in global affairs due to the simultaneous emergence of climate change, the COVID-19 pandemic, and political instability. Indeed, individual shocks cannot necessarily be predicted and prevented. However, recent events have indicated that crises are a defining characteristic of our current social-ecological landscape. Renowned scholar and diplomat Harlan Cleveland

(1963) wrote 1963 “crises are normal, tensions can be promising, and complexity is fun.” (cited in Koff & Maganda, 2020) in response to uncertainties related to Cold War tensions. Cleveland’s perspective remains relevant today as crises do threaten social-ecological systems. However, these very shocks may provoke tensions that can be promising if they promote development models aimed at reinforcing a safe and just space as defined above. Complexity, of course, is also a characteristic of social-ecological crisis response due to the presence of tradeoffs in policymaking. For this reason, this dissertation has adopted a policy coherence for development perspective.

Literature review on Policy Coherence for Development

This literature review had as main sources of information Sianes, (2017) conceptual framework article, which provides a historical and systematic analysis of Policy Coherence for Development (PCD) as well as three key OECD reports that define PCD and Policy Coherence for Sustainable Development (PCSD) and 7 articles framing PCD in the framework of 2030 Agenda implementation. The goal of the literature review was to understand the historical evolution of PCD as a normative principle in development cooperation as well as its development as a tool in both the development and sustainability arenas.

Policy Coherence for Development emerged as an important policy tool in the 1990s. It has been adopted by the EU through the Maastricht Treaty in 1993 and the Cotonou Partnership Agreement in 2000(Koff & Maganda, 2016a; Laakso et al., 2007). It has also been in the dominant discourse on development from the OECD since the early 1990s. In the Sustainable Development Agenda, the UN has

embraced PCD, and it is specifically referenced in Target 17.14 as one of the governance mechanisms through which the UN and member states are pursuing the implementation of the SDGs. In terms of natural resource management, the UN is promoting PCD through its CLEWS program (climate, land use, energy, and water) which examines how investments in one strategic resource affect others (Koff & Maganda, 2019).

The OECD in its 2012 working paper “Policy framework for Policy Coherence for Development” defines PCD as a concept that aims to exploit positive synergies and spillovers across public policies to foster development; it entails the systematic application of mutually reinforcing policies and integration of development concerns across government departments to achieve development goals along with national policy objectives. Citing the DAC Journal of Development Co-operation, OECD draws on the idea that “Policy coherence means different policy communities working together in ways that result in more powerful tools and products for all concerned. It means looking for synergies and complementarities and filling gaps among different policy areas to meet common and shared objectives”(Organisation for Economic Co-operation and Development, 2016).

OECD work on PCD mentions prominently, a “whole of government” approach which is valuable to better understand the potential impacts of domestic policies on development and to effectively implement PCD. PCD also requires the development dimension to be given adequate weight throughout and at every stage of the policy design and reform across the government. OECD mentions the importance of pursuing PCD in several stages of the policy cycle. Something to be

noted is that OECD also puts high emphasis on how PCD can only be achieved as "a collective effort and through an open and inclusive framework, based on the active involvement of emerging economies, developing countries, and international organizations. Greater balance in the global governance architecture could be critical to achieving an effective PCD" (Organisation for Economic Co-operation and Development, 2012).

In the context in which it was originally proposed -development aid- the issue discussed by PCD principles is what high-income countries can do through their international policies to help low-income countries and promote development, and ensure that their efforts in development cooperation are not affected but reinforced by the rest of their policies in other policy arenas (Sianes, 2017). Sianes (2017) mentions in his PCD conceptual article, how Forster and Stokke (1999 in Sianes, 2007) identified four areas of PCD: (i) the consistency between agendas of various agencies and institutions engaged in development cooperation at the country's development cooperation (ii) the consistency of various policies implemented by a donor country regarding the recipient countries; (iii) the coherence of all policies implemented by donor countries (through supranational institutions) for recipient countries and (iv) the coherence between donor cooperation (either country or supranational) and the development policies of recipient countries. Later, Hoebink 2004 built on Forster and Stokke's (1997) argument and defined two levels and three degrees of coherence. The first level regards exclusively development policy, asking for consistency among different objectives and/or instruments in the development arena. Subsequently, the next level refers to incoherence between different sets of

foreign policy and development cooperation policy. At the broader level, Hoebink set external consistency as “the level of coherence between development cooperation policies and policies in other fields” (Sianes, 2017). In 2005, Picciotto contributed with a larger classification; (i) internal coherence: the consistency between goals and objectives, modalities and protocols of a single policy or program (in a specific arena) in support of development; (ii) intra-country coherence: the consistency among several aid and non-aid policies of a country regarding their combined contribution to development; (iii) inter-country coherence: the consistency of aid and non-aid policies in several countries in terms of their aggregate contribution to the development and (iv) donor-recipient coherence: the consistency of policies adopted by donor countries collectively and recipient countries (individually or collectively) to achieve shared development objectives (Sianes, 2017). The before-mentioned classifications contributed to extending the understanding of the interactions between policies in various levels and arenas, highlighting the importance of PCD as a principle.

From Policy Coherence for Development to Policy Coherence for Sustainable Development

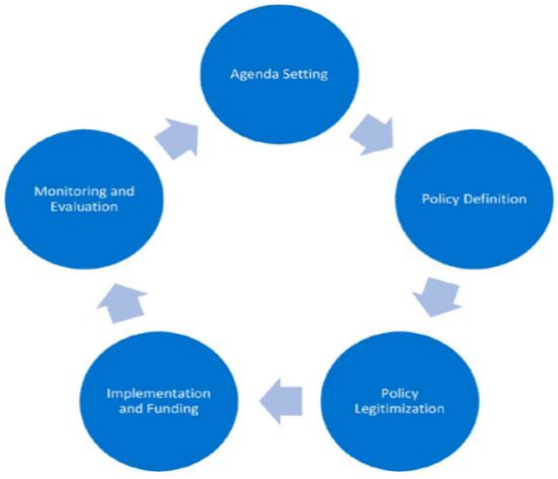
As mentioned before, as a response to goal 17 of the 2030 Agenda: “strengthen the means of implementation and revitalize the global partnership for sustainable development” and addressing the need for global cooperation and commitment to the 2030 Agenda, in 2016, the OECD published the framework: Policy Coherence for Sustainable Development (PCSD). In this document OECD positions PCSD as going “one step further, moving beyond a “do-no-harm” approach and towards a

partnership approach based on “win-win” solutions” (OECD, 2016). PCSD is appointed as fundamental for fostering synergies between economic, social, and environmental policies in the implementation of the Sustainable Development Goals (SDGs) and taking into account the multinational and intergenerational effects of policies on well-being. In this document OECD poses eight guiding principles for the implementation of PCSD including (1) strong commitments and leadership at the highest political level, (2) defining, implementing, and communicating strategic long-term visions that support PCSD, (3) policy integration across economic, social and environmental spheres, (4) “whole of government” coordination at the national level, (5) engagement of actors at sub-national levels of government, (6) integration of stakeholders in decision-making processes, (7) analyses of policy and finance impacts, and (8) strengthening of monitoring, evaluation, and reporting of PCSD in specific policy contexts (Organisation for Economic Co-operation and Development, 2021). In this regard, Koff and colleagues argue that “the first of these principles is crucial for the facilitation of sustainable transformative development because it targets normative sustainability commitments” (Koff, Challenger, et al., 2022, p. 2). Normative commitments stand as the foundation of policy coherence, as this is part of the first stage of the policy cycle and without normative coherence. The OECD specifically calls for the following measures: a. Define priority areas, time-bound action plans, and key performance indicators for making progress on PCSD and communicating results to the public; b. Systematically apply a poverty, gender, and human rights perspective to PCSD frameworks in line with the 2030 Agenda ambition of ending poverty in all its forms everywhere, empowering all women and girls, and achieving gender equality; c. Introduce measures to promote PCSD within

government structures so that commitment to PCSD outlives electoral cycles and changes in government, cabinet compositions, or government programs, including identifying a lead institution, responsible for promoting, overseeing, and implementing PCSD; d. Build leadership capacity in the public service to consistently formulate, implement, and monitor policies coherent with sustainable development across sectors (Organisation for Economic Co-operation and Development, 2021).

Larsson, (2018) has highlighted the value of PCSD because this approach addresses each stage of the policy cycle, including agenda setting, policy definition, policy legitimization, policy implementation (including both data and funding), and policy monitoring and evaluation (see figure 4). In this regard, Koff, (2017) notes how PCD has been a normative tool adopted by multilateral institutions, several governments, and policymakers. PCD is broadly seen as an evaluation tool and as a desired outcome. Despite the widely spread use of PCD as a goal, significant criticisms have been raised on its implementation remain prominent.

Figure 2. Stages of the Policy Cycle. Source: Koff & Maganda, 2019.



Koff & Maganda, (2019) effectively summarize this. They start by pointing out that first, scholars such as (Siitonen, 2016) have argued that the implementation of PCD by supranational organizations has been limited to their policies or those of their member states. This had the result of PCD been used not to detect incoherences that exist in parts of the world where development occurs. Moreover, because this tool has been implemented in a donor-centric way, Thede (2013) contends that it reinforces global inequalities by highlighting the differences between aid donors and aid recipients. Similarly, Koff and Maganda (2016 in Koff & Maganda, 2019) have shown how "supranational organizations, such as the European Union, have employed PCD as a policy tool to improve the efficiency of their programs at the expense of normative change and global equity". Finally, Carbone and Keijzer (2016)have shown how PCD has been pursued through institutional reform more than policy implementation.

As an analytic tool, PCD "examines how non-development policy arenas undermine or support development objectives and analyzes how mechanisms within development policies similarly reinforce or weaken development strategy objectives" (Koff, 2017). Policies can either undermine or ensure the pursuit of specific objectives, such as sustainable development, and gender equality amongst others. Due to the commitments to policy coherence in the 2030 Agenda, PCD has gained visibility as a policy tool too. The European Union and several International Organizations advocate PCD as a policy tool to assess the impacts of policies (in its various forms) for developed and developing countries and to improve cross-sectoral governance in all countries. PCD and PCSD have become tools with a normative value widely recognized: they are critical to deal with the implementation challenges

in addressing an integrated, transformative, and global agenda (Morales, 2018; Righettini & Lizzi, 2022). In their sustainable development analysis, Koff et al. (2020), have identified eight typologies of PCD determining how policies either contribute to or undermine sustainable development (see table 1).

Table 1. Typologies of Policy (In)coherence for Development. Source Koff, Challenger & Portillo (2020).

Typology of (In)coherence	Definition
Horizontal (in)coherence	(In)coherence between development and non-development policies
Vertical (in)coherence	(In)coherence between policies of regional organizations, member states, municipalities
Inter-donor (in)coherence	(In)coherence between development policies/projects of different donors
Internal (in)coherence	(In)consistencies between the objectives and means of a given policy (i.e., measurement techniques, monitoring)
Inter-organisational (in)coherence	(In)coherence between the development policies of a country's government and civil society organizations
Multilateral (in)coherence	(In)compatibility between the development goals and procedural norms of international organizations such as the EU, OECD, the UN, and the international financial institutions
Financial (in)coherence	(In)coherence between the structure of development funding and policy objectives
Normative (in)coherence	(In)coherence between policy strategies in development and non-development policy arenas and core values of liberal democratic societies

Koff and colleagues contend in their article that PCD "should be implemented as a methodology that can be adopted by domestic government and non-governmental actors alike, to understand trade-offs and co-benefits within and between policy sectors, thus promoting a participative approach.

Criticism on PCD

In terms of PCD/PCSD, there has been a lack of domestic implementation as this approach has been limited to the programs of supranational and bilateral development cooperation (Siitonen, 2016). Scholars such as Moure et al. (2021) have engaged in this discussion. Moure et al. (2021) examine PCD implementation in Mexico with the goal to uncover why, despite PCD's widespread theoretical value,

PCD is still hard to achieve. Focusing on the perception of the stakeholders in charge of agenda operationalization, the article shows how institutional arrangements and work culture significantly limit this approach's normative impact on development policy implementation. Koff et al. (2020) highlight PCD's institutionalized character which limits normative impact due to the absence of mechanisms for citizen participation. The authors promote a model of "participative policy coherence for development" to improve the local impacts of PCD. Larsson (2018) and Koff et al. (2021; 2022) have proposed applying PCD to domestic policy tools, such as Environmental Impact Assessment, Development and poverty social programs, and state and national laws to strengthen PCD's impact on domestic sustainable development.

Study case

Coffee production is vital for social-ecological systems

Coffee production contributes to the economy of the regions in which it takes place, and it has social and environmental added value. The Food and Agriculture Organization of the United Nations (Food and Agriculture Organization of the United Nations, 2022) states that "coffee is the most widely traded tropical product, with up to 25 million farming households globally accounting for 80 percent of world output. Production is concentrated in developing countries, where coffee accounts for a sizeable share of export earnings and provides a key source of livelihood for households". Coffee plantations as agroforestry systems are key social-ecological systems. Shade coffee plantations can significantly help to keep to a degree components of native forests and preserve a sizeable amount of important

ecosystem services such as carbon storage, biodiversity conservation, and stopping soil erosion (de Leijster et al., 2021). On the other hand, coffee production is an extremely important agricultural commodity due to its wide geographical range of occurrence and socioeconomic importance. It is produced in 80 tropical countries and an estimated 125 million people's livelihoods depend on it in Latin America, Africa, and Asia, with an annual production of about nine million tons of green beans (Krishnan, 2017). The coffee market is valued at over USD 200 billion annually, creating significant economic opportunities for growers and downstream value chain actors (International Coffee Organization, 2020; Krishnan, 2017). Growing demand for coffee, in the last 30 years, resulted in the expansion of coffee production and exports. Global coffee production has increased by more than 60% since the 1990s. The value of annual cross-border coffee exports (all forms, i.e., green, roasted, soluble) has increased from USD 8.4 billion in 1991 to USD 35.6 billion in 2018 (International Coffee Organization, 2019).

Despite the fall of Mexico as one of the main producers, coffee production is socially and economically important in the country (Centro de Estudios para el Desarrollo Rural Sustentable y la Soberanía Alimentaria, 2018). Mexican coffee farming involves around three million people throughout the value chain, of whom almost half life in areas classified as highly marginalized (Gálvez-Soriano & Cortés, 2021). Coffee plantations cover a surface of almost 700 000 hectares, 3.3% of Mexican agricultural land. According to the Rural Sustainable Development Law, coffee production is a strategic and fundamental activity. Coffee production integrates productive chains, and generates income and jobs, being the livelihood of small producers, some of them belonging to thirty indigenous groups. About 90 % of

the coffee cultivated surface in Mexico is under diversified shade, which confers coffee production ecological value due to the ecosystem services it provides. Despite the importance of coffee production in Mexico, it has been immersed in recurring crises, which have had consequences at different levels for small coffee producers (Hernández Sánchez & Nava Tablada, 2019). Coffee-producing regions experience several problems: a decrease in the number of jobs, an increase in migration, environmental degradation due to land use changes, an increase in plagues and diseases affecting the grain quality, low performance, old plantations, and abandonment of the coffee plantations, amongst others (Hernández Sánchez & Nava Tablada, 2019).

Most producers in Mexico work on small plots, use traditional technology for coffee production, and, in general, rely only on family labor. According to information from the United States Department of Agriculture, in recent years, production costs have increased due to the lack of workers in the field, whose labor represents more than 80 percent of total production costs (Elms, 2019; Gálvez-Soriano & Cortés, 2021).

Coffee producers' income depends on exogenous factors such as international prices, exchange rates, climatic conditions, migration, etc. They also rely on alternative sources of income. Therefore, there are several interlinked problems that contributed to coffee production in Mexico being an economically unsustainable activity, in many of the producing states.

Coffee production in Mexico: a brief history of shocks

One of the macro-economic events that contributed to the volatility of coffee beans prices in the world, and had strong impacts on Mexico, was the suspension of the International Coffee Agreement in 1987. The release of the coffee beans surpluses of the coffee producer countries, into the international market, led to a sustained drop in prices (Galvez-Soriano & Cortés, 2021).

The low proficiency of coffee growing has been historically attributed to three main causes: high production costs, low “stock market” prices or traditional market of raw materials, and low productivity. This is related to coffee plantations established in marginal areas, outside the geography of the productive potential; the adoption of technology limited by the lack of and/or access to investment capital; and production systems with management and post-harvest processing practices that are not in line with the quality demands of the national and international aromatics market (Galvez-Soriano & Cortés, 2021).

The liberalization of the market has allowed Mexican coffee to reach more consumers but on the other hand has produced vulnerability of the coffee producers, due to volatile prices and competition in the international market. It has been suggested that the determination of the local price equilibrium of coffee does not depend on the demand or supply of the Mexican market, but it is determined by international price (Gálvez-Soriano & Cortés, 2021). Under this condition, the International Coffee Agreement was canceled, which worked to stabilize the market by verifying the annual production of coffee in member countries to avoid an over demand. This brought a transformation of the regulatory coffee system to a market-dependent system in which the presence of transnational enterprises was the most notorious characteristic and a weakening of the producing countries with the fall of

international prices. In the Mexican case, as (García & Perales, 20describesribe, due to the elimination of the Mexican Institute of Coffee in 1989, producers were left at the will of transnational industries, which led to the loss between 10% and 60% of the functionality of national coffee processing plants (Galvez-Soriano & Cortés, 2021).

The Mexican Institute of Coffee (INMECAFE for its syllables in Spanish), established in 1958, was the national regulatory body for coffee. It had mainly four attributions: 1) control prices and export permits, 2) develop technologies to increase coffee yield, 3) protect the soil, 4) control plagues, pests, diseases, and fertilization. INMECAFE promoted policies aiming to stabilize coffee market demand and offer. It provided coffee producers with technical assistance, dictated a minimum fixed price for coffee beans, designed and implemented programs to promote producers' organization, and anticipated payments on account of harvest and reception of coffee (Argüello, 2016). As INMECAFE also collected and traded coffee, its elimination had resulted in producers without financial and material resources to fertilize, control pests and shade, or replant neglected their plantations. This situation continues to happen (Renard, 2022). Therefore, INMECAFE's disappearance left a great vacuum in the value chain, a situation that has lasted until the present day (Hernández Martínez & Córdova Santamaría, 2011; Ramos Rivera et al., 2021).

Because coffee production and sales are not profitable due to low prices, farmers have combined this crop with other productive activities, such as timber harvesting, cattle raising, and monoculture crops such as sugarcane, or by working in the construction industry in the cities (Manson et al., 2008).

In 2012 the biggest outbreak of coffee rust happened in all the coffee-producing regions of Mexico, adding up to the previously mentioned conditions. This led to a lower harvest than in previous years and therefore a change from arabica traditional varieties to other species and varieties that are more resistant but of less quality (Escamilla Prado & Landeros-Sánchez, 2016).

The rust also caused the burning of a large number of plants, whose reseeding would implicate at least 3 years of waiting to harvest again (Batista, 2018 Ramos Rivera et al., 2021). Besides being more resistant to coffee rust, the new species and varieties -mostly that which is commonly called “robusta”- have a higher yield production, which is why producers have chosen to sacrifice quality for productivity. This change led to the reduction or elimination of shade since these new varieties and species are more productive when exposed to the sun. The shade reduction resulted in the loss of the capacity of coffee plantations to be a reservoir of animal and plant species. At the same time, this implied the loss of a food and complementary income source for producers, since these before-shaded plantations used to be edible forests. Between coffee plants, producers used to insert fruit trees such as tangerines, oranges, and other edible plants such as bananas (Sosa Fernández, 2017). Despite the importance of this agroforestry system, there is a lack of a cross-sectional analysis of the policies affecting the coffee sector in Veracruz. There is an urgent need to identify synergies and tradeoffs resulting from policy interactions and therefore, propose recommendations for the sector’s sustainability.

Research Design: Coffee-Producing Communities in Veracruz

The study case is Veracruz as a coffee-producing region. Veracruz is the second-largest coffee-producing state in Mexico. Coffee plantations cover 139, 000 hectares, in which the varieties used are high-quality varieties of *Coffea arabica:* tipyca, bourbon, mundo novo, caturra, garnica, and others less represented. Since coffee rust appeared, the use of rust-resistant varieties has increased such as catimores and sarchimores, the result of a hybrid between Timor, originated by a cross of arabica and robusta *(Coffea canephora).* The coffee-producing region is distributed in 842 communities and 82 municipalities, with close to 86 000 producers including indigenous peoples belonging to nahuatl, Popoluca, and Totonaca cultures. Ten coffee growing regions stand out: in the northern zone are Huayacocotla and Papantla; in the south, Tezonapa and Los Tuxtlas, while in the center are Zongolica, Córdoba, Misantla, Coatepec, Atzalan, and Huatusco (Hermida, 2018). The central zone contributes 80% of the state's total coffee production (Castillo, 2019) and is recognized in the international market for its quality. The predominant ecosystem in this zone is the mesophilic mountain forest, known as cloud forest, which has great biodiversity and unique species of flora and fauna (Gordon et al., 2007). After the rust hit the coffee plantations it was estimated that production was reduced by 65%, especially in the region of Coatepec. Veracruz coffee is recognized as one of the best ones in the world, winning four consecutive times the Excellency cup in Alliance for Coffee Excellence contest. The coffee landscape is shaped by a forested stripe that safeguards a vt biodiversity: only in Coatepec's region 110 tree species were registered (González-Zamora et al., 2016; López-Gómez et al., 2008) and it is the refugee for amphibians, birds and, mammals as well, as documented by several scholars (Gallina et al., 1996; Saldaña-Vázquez

et al., 2010). On the other hand, it is a meaningful livelihood to peasants in Veracruz since it provides not only a source of income but of food similar to the milpa system, in which the plantations not only produce coffee but fruits and other edible plants. Veracruz coffee producers are mostly small producers, called minifundistas with no more than 3 hectares of plantation under shade and traditional management (PRONATURA Veracruz, 2018).

Veracruz coffee sector is highly relevant for the social, economic, and, ecological prosperity of the state and the country, contributing to the livelihood of small landholders, sustaining traditional livelihoods and indigenous cultures, and constituting a source of ecosystem services such as biodiversity conservation, weather regulation, soil protection, and water production. Due to the interlinked natural, economic, and social processes that are immersed in coffee systems in Veracruz, and the crisis that they have experienced in the past 40 years, the Veracruz coffee region constitutes a relevant study case to address the vulnerability of social-ecological systems and normative coherence for the safe and just space as a new pathway for crisis response and sustainability.

Expected outcomes and intended contributions

As stated above, resilience has emerged as a fashionable reference in sustainability discussions due to the presence of overlapping crises in global affairs, such as the Covid-19 pandemic, climate change, and strategic conflict, such as the war in Ukraine with its far-reaching economic and energy consequences. While resilience has emerged as a concept, it has not yet been operationalized and implemented in development strategies. This dissertation aims to fill this need. Using

the “safe and just space” proposed by Raworth as a development goal, it proposes a model of development aimed at promoting social equity while simultaneously preventing ecological degradation (what Raworth refers to as overshooting the environmental ceiling). In doing so, it forwards a vision for development aimed at reinforcing the resilience of socioecological systems.

The proposed originality of this dissertation is the means by which this conceptualization is operationalized. This research contends that development strategies can be evaluated by understanding the orientation of their definition and the effectiveness of their implementation. Thus far, evaluation is a weaker aspect of development policymaking (see Koff et al., 2020). To promote resilience, this study forwards evaluation based on normative coherence for sustainable development and antifragility. As shown in the literatures above, these concepts are generally utilized as policy objectives. Instead, this dissertation argues that they can be operationalized as evaluation benchmarks for the purpose of forwarding the resilience of socioecological systems. Normative coherence for sustainable development, which will be defined in chapter two, addresses the definition of development strategies and their appropriateness for addressing vulnerabilities in socioecological systems. Antifragility is then operationalized through evaluation benchmarks to address how policies are implemented in these territories which either reinforces or undermines their effectiveness. Through these techniques, this dissertation proposes an evaluation model which aims to identify mechanisms for the promotion of resilience amongst policies: pinpointing whether resilience challenges are caused by inappropriate policy definition, ineffective policy implementation, or both. This analysis can provide insights to be used for policy

recommendations aimed at addressing shocks that affect a community's social-ecological integrity.

Chapter 3. Conceptualization: Normative Coherence and Antifragility for a Safe and Just Space

Introduction: the social construction of vulnerability

Vulnerability has been the key concept of disaster studies for at least the last 40 years. In the last 20 years, this concept has been overtaken but also integrated into the global discourse on resilience and climate change as well. Therefore, vulnerability is seen as the flipside of resilience. Nevertheless, vulnerability is a powerful concept that should still be at the center of political and academic discussions around disaster management, prevention, and mitigation. The concept of vulnerability has been powerful since it "explains the differentiated impact of hazards and highlights the socially constructed nature of vulnerability – and hence of disasters – as produced by politics, economic processes, and social exclusion (Bankoff et al. 2004). Disasters are the result of the interaction of hazards (events with natural causes) and vulnerability (Wisner et al., 1994). One of the seminal works on the social production of vulnerability, stresses how the "relative position of advantage or disadvantage that a particular group holds within a society's social order, renders it unsafe" (Hilhorst & Bankoff, 2022, p.2). The power that the concept of vulnerability has is that "it explains the differentiated impact of hazards and highlights the socially constructed nature of vulnerability as produced by politics,

economic processes, and social exclusion" (Bankoff et al., 2004, p. 2). Vulnerability places stress on the processes (political, social, economic, and environmental) that put people at risk, ensuring that other discourses and concepts, such as resilience, don't mask relevant conditions such as social inequalities and absolve the states from their duty to care (Hilhorst & Bankoff, 2022). The proponents of vulnerability (back in the70ss) criticized the practices of transnational capital and the unfavorable terms of trade they imposed upon poorer nations. They argued that communities were rendered exposed by the relative position of advantage or disadvantage that particular groups occupied within a society's social order, leading to a power asymmetry. Vulnerable people were at risk not only because of exposure to hazards, but because of a combination of variables such as class, caste, ethnicity, age, gender, and disability (Wisner et al., 1994) that determined people's entitlements and affected their command over necessities and rights (Hewitt, 1997; Watts, 1993). The world has seen several economic and political changes from the time of this statement until now. But probably, in the last 50 years, the biggest change has been environmental. Climate change is now a real and pressing concern. The acknowledgment of this reality, led to the introduction of the concept of disaster risk creation. Risk is sometimes viewed as the product of hazard + exposure + vulnerability (Viner et al., 2020). "Disaster risk re-emphasizes the causes of disaster risks, and, importantly, recognizes that disaster risks are created through human interference with natural hazards, the social production of vulnerability, the neglect of response capacities, or a combination of all three" (Hilhorst & Bankoff, 2022, p. 7). In fact, due to the ongoing climate change crisis, scholars such as Viner et al. 2022 recognize the value of perspectives that emphasize the changing nature of

hazards, exposure, and vulnerability, variables of the general equation of risk. The Intergovernmental Panel on Climate Change (IPCC) defines risk as resulting "…from the interaction of vulnerability, exposure, and hazard…" (Pörtner et al., 2022).

García Acosta (2018) proposes vulnerability as a variable related to existing internal contradictions in a system, the hierarchy of functions in any society, and the social complexity that underlies each disaster. In his work on global vulnerability, (Wilches-Chaux, 1993), defined 10 types of vulnerabilities to address different dimensions of the concept. Building on the description of Wilches Chaux typologies and selection done by Koff and colleagues (2022) some typologies relevant for the aims of this research are: *physical vulnerability* which is related to the location of population groups in areas of high physical risk (determined by topography and geological conditions of the territories), under conditions of poor hazard absorbing infrastructures in housing and buildings and lacking alternative relocation options; *economic vulnerability* linked to poverty, lack of employment, the scarcity of economic resources and lack of economic diversification, including economic dependence at the community level; *social vulnerability* which refers to the low degree of organization and internal cohesion of communities; *political vulnerability* which refers to the centralization of decision-making as a factor that weakens the levels of local autonomy to decide the most appropriate action strategies and *ecological vulnerability* referring to development models that dominate and destroy environmental reserves, leading to vulnerable ecosystems incapable of self-adjustment. Vulnerability is both produced under a given set of historical-geographical conditions and patterned along a complex set of

socioeconomic characteristics that include income, wealth, land and property ownership, as well as the ability or lack thereof to access a range of essential goods, services, and natural resources (Cavanagh, 2016). In this research, vulnerability is the result of the interaction between social inequality and environmentally exposed conditions. A vulnerable system is one in which there is social inequity and an overshoot of the planet's capacity to sustain life.

The safe and just space

In the section preceding this one, vulnerability is conceived as the outcome of the lack of social equity -that can be observed and involves the social and economic spheres of an SES- interacting with an inadequate mobilization of natural resources -the environmental sphere of an SES- that leads to alterations in earth's cycles making them unable to sustain life. The before-mentioned description of a vulnerable SES is the opposite of an SES that thrives in the safe and just space.

This section aims to introduce the Doughnut model and the safe and just space as the balanced model for which policies should be coherent. The safe and just space responds to the model of vulnerability addressed by the dissertation. Because this study is embedded in social-ecological systems, it directly addresses social and environmental vulnerability as core concepts. In the Doughnut model proposed by Raworth (2012), societies must address social foundations of equity while avoiding overshooting an environmental ceiling. Not respecting these terms contributes to either social or environmental vulnerability. Undermining both objectives would create a situation of social-ecological vulnerability which represents a worst-case scenario in this study.

The safe and just space is originally presented as a “doughnut” economic model (see figure 1): “The environmental ceiling consists of nine planetary boundaries, as set out by Rockstrom and colleagues (2009), beyond which lie unacceptable environmental degradation and potential tipping points in Earth systems. The twelve dimensions of the social foundation are derived from internationally agreed minimum social standards, as identified by the world’s governments in the Sustainable Development Goals in 2015. Between social and planetary boundaries lies an environmentally safe and socially just space in which humanity can thrive” (Raworth, 2017, p. 295). The social boundaries have as a core element human rights which assert the fundamental moral claim each person has to life’s essentials – such as food, water, health care, education, freedom of expression, political participation, and personal security (Raworth, 2017). Raworth’s model responds to the need of ensuring that no one falls short of life’s essentials, while collectively we do not overshoot Earth’s life-supporting systems, on which we fundamentally depend. In short, it seeks to maintain the integrity of social-ecological systems. In this sense, Raworth’s doughnut model relates to the general risk equation because it accounts for reducing vulnerabilities that are socially constructed, by proposing specific indicators to measure them and strategies to improve them (social foundation and planetary boundaries); it highlights the importance of protecting life’s supporting systems since its depletion can result in hazards and addresses how the current development and economic model has led to more exposure.

In this research, the Doughnut model is taken as a development model that embraces hard sustainable development. Therefore, the safe and just space is defined “as a space in which social equity is ensured while mobilizing and using natural resources without overshooting the planet’s capacity is possible”. Social-ecological systems should exist in the safe and just space and by doing so, they will be able to self-reproduce.

The nine planetary boundaries are proposed in terms of climate change, biodiversity loss, ocean acidification, chemical pollution, nitrogen and phosphorus loading, freshwater withdrawals, land conversion, biodiversity loss, air pollution, and ozone layer depletion. Raworth lists a set of parameters for each of the social and planetary boundaries which adds up to the usefulness of this framework because it sets the milestones for implementation (tables 2 and 3) and assessment.

Table 2. Planetary boundary parameters (Source: Raworth, 2017).

Earth-system process	**Parameters**
Climate change	Atmospheric carbon dioxide concentration (parts per million by volume)
Ocean acidification	Global mean saturation state of aragonite (calcium carbonate) in surface seawater, as a percentage of pre-industrial levels

Chemical pollution	Amount emitted to, or concentration of persistent organic pollutants, plastics, endocrine disrupters, heavy metals, and, nuclear waste in, the global environment, or the effects on ecosystem and functioning of Earth system thereof
Nitrogen and phosphorus loading	Phosphorus and reactive nitrogen applied to land as fertilizer (millions of tons per year)
Freshwater withdrawals	Blue water consumption, cubic meters per year
Land conversion	Area of forested land as a proportion of forest-covered land prior to human alteration
Rate of biodiversity loss	Extinction rate (number of species per million species per year)
Air pollution	Overall particulate concentration in the atmosphere, on a regional basis*
Ozone layer depletion	Concentration of ozone in the stratosphere (Dobson unit)

Table 3. Social dimensions of the “doughnut model” (modified from Raworth, 2017).

Social dimensions	**Parameters**
Political voice	Voice and Accountability Index
Peace and justice	Corruption perception Index and Homicide rates
Education	Adult illiterate population percentage and children between 12-15 years old out of school
Health	Mortality rate of population of under five percentage and population with life expectancy at birth of less than 70 years percentage
Food	Undernourished population percentage
Water	Population without access to improved drinking water percentage and population without access to improved sanitation percentage
Energy	Population lacking access to electricity percentage and population lacking access to cooking facilities percentage

Social equity	Population living in countries with a Palma ratio of 2 or more (the ratio of the income share of the top 10% to that of the bottom 40%) percentage
Gender equality	Representation gap between women and men in national parliaments percentage and worldwide earning gaps between women and men percentage
Housing	Global urban population living in slum housing in developing countries percentage.
Networks	Population without support and trust networks and population without internet access percentage.
Income and work	Population living on less than the international poverty limit of $3.10 a day and proportion of people between 15-24 seeking but unable to find a job percentage

The before-mentioned environmental parameters and social dimensions build the basis to address vulnerability of SES. Raworth, (2012) set up a concise framework of indicators that constitute the guiding path for policies that effectively promote balanced development strategies resulting in a SES with balanced conditions in the social, economic and environmental spheres and therefore, a SES that thrives in the safe and just space.

What is behind the doughnut?

As mentioned in the introduction chapter of this dissertation, the safe and just space as described as Raworth is the opposite of vulnerability of SES. Therefore, it is necessary to address the principles that consolidated Raworth's model as they provide theoretical and normative substance for the building blocks of the normative model I propose as a new pathway to respond to crisis and address vulnerability. After it's seminal work on the doughnut model, Raworth got to the task of explaining the normative foundation as well as some examples of how, the safe and just operating space for humanity could be turned into reality.

Raworth (2017) lists seven ways to re-think the economy, which are the foundation for her Doughnut Economics model. I use six of them as the normative basis of the safe and just space: 1) Change the goal; 2) See the big picture; 3) Nurture Human Nature; 4) Get Savvy with systems, 5) Design to Distribute and 6) Create to Regenerate. In the following sub-sections, I briefly describe these principles to set the core of our ideal type of SES and to support the operationalization of policy coherence for the safe and just space approach. I explain why each principle is important for the resolution of SES vulnerability.

See the big picture

Since the moment it has appeared in the early 1930's, GDP has been risen as the main metric to measure economic growth. Due to it's easy to grasp character and its straightforward measurement, it has gained international attention and become one of the core goals of economic systems across the world. There has

been some evidence of how, in fact, in certain economies, the growth of GDP comes with an improvement of other aspects surrounding the economy (OCDE et al., 2019), but still, these results leave some questions unanswered, and conclusions do not seem to be sufficient to sustain the argument that GDP increase should be the ultimate goal of the capitalism. In fact, pursuit of GDP represents modernization theories of development which promote linear views of progress and growth is presented as a barometer for success, despite potentially destructive consequences for social equity (well-being) and environmental conditions (see Roberts & Hite, 2007).

Emerging economies have shown that while they are growing, an increase of GDP can (but not always) lead to the improvement of living conditions until certain growth is reached (OCDE et al., 2019). On the other hand, massive flow of capital into national economies, if not accurately regulated, can have destructive effects on social cohesion and environmental integrity (Fioramonti, 2013). One of the first ones to challenge this idea was the systems thinker Donella Meadows (1999 in Raworth, 2017), who back in the 90's declared: 'Growth is one of the stupidest purposes ever invented by any culture,'. In response to the constant call for more growth, she argued, we should always ask: 'growth of what, and why, and for whom, and who pays the cost, and how long can it last, and what's the cost to the planet, and how much is enough?' (Raworth, 2017). These are some reasons why, some economists such as Raworth, Sen, and Stiglitz, propose a change of focus: GDP increase shouldn't be the unique solution, neither the ultimate purpose of the economy. Economy serves the purpose of development and development should be focused

on realizing a set of fundamental human needs. Sen identifies capabilities, setting the starting conditions as equally as possible for everyone to meet their basic needs. Changing the goal would mean to really question what we want to achieve through development. Raworth proposes that we should look at what makes humanity thrive. Inspired by the 2030 Agenda, which she recognizes as a tool that has made some progress by bringing to the table several stakeholders and having a consensus around what will be desirable to achieve, she focuses mainly in twelve basics of life: sufficient food; clean water and decent sanitation; access to energy and clean cooking facilities; access to education and to healthcare; decent housing; a minimum income and decent sufficient food; clean water and decent sanitation; access to energy and clean cooking facilities; access to education and to healthcare; decent housing; a minimum income and decent work; and access to networks of information and to networks of social support. Furthermore, the SDGs call for achieving these goals with gender equality, social equity, political voice, and peace and justice.

Distribution matters just as much as population because extremes of inequality push humanity beyond both sides of the Doughnut's boundaries. Distribution is defined in terms of the responsibilities and harm done by the distribution of resources. As an example, thanks to the scale of global income inequality, responsibility for global greenhouse gas emissions is highly skewed: the top 10% of emitters generate around 45% of global emissions, while the bottom 50% of people contribute only 13% (Chancel & Piketty, 2015).

In *Mismeasuring Our Lives: Why GDP Doesn't Add Up*, Nobel Prize winning economists Joseph Stiglitz, Amartya Sen, and Jean-Paul Fitoussi (Mazzucato, 2021)

contend that indicators represent political choices. They contend that focus on growth and Gross Domestic Product as an indicator of successful development contributed to conditions for economic crises. In fact, other scholars, such as (Mazzucato, 2021) have further promoted this message in their analyses of the interactions between capitalism and global crises. “Changing the Goal” is more than just a slogan. If SES are to be socially and environmentally reinforced to protect against crises such as recessions, pandemics, climate change, etc. then goals beyond growth must be established as new benchmarks for successful development. The shift from GDP and growth-based development models will also mean that, exposure and vulnerability and the emergence of hazards can be reduced: life sustaining cycles will be less affected, leading to a decrease in hazards such as the ones caused by climate change, exposure could be lowered since focusing on improving life conditions will tackle the socioeconomic and structural and causes of vulnerability. This is explained in further detail below.

See the big picture

If we are going to change our goals in order to promote more sustainable economies, then new development models need to be defined and implemented. Many “alternative” paradigms have already been proposed: circular economy (see (Webster, 2015), post-growth (see Jackson 2018) and buen vivir (Ranta, 2018). Raworth (2017) contributes to this debate by proposing a new economic model: The Embedded Economy. This comes as a response to the neoliberal model in which household contributions to the economy were not recognized, commons are seen as something problematic, so they better be sold, society is not existent, and earth’s

boundaries and the flows of energy and resources were not even in the picture (considered as an inexhaustible source of resources). Finally by excluding power distribution, the approach shows that the neoliberal model is leaving fundamental elements aside. In the Embedded Economy, the feedbacks and resource flows between the earth, society and economy are recognized. In its core are the household, the market, the state, and the commons.

One of the contributions of these alternative economic paradigms, is to reduce the negative externalities of production and consumption. Externalities are broadly defined as “effects flowing from a market that are not taken into account by the participants in that market” (Field, 2021, p. 11). Even though negative externalities are the most cited, such as pollution, positive externalities also exist. Education is a positive externality for companies since the government invests in it and companies benefit from having qualified and highly educated work force, Circular economy for example, proposes recycling materials and reintegrating them to the production cycles. Such is the case of some metals, whose recycling reduces pollution and environmental degradation resulting from the obtention of “virgin” metals from nature (Field, 2021). By doing this, we will be contributing to reduce hazards resulting from the accumulation of these externalities, as happens with climate change.

On the other hand, the Embedded economy model then sets the often neglegted elements by linear economy, according to their importance: for earth, society, economy, household, market, finance, business, trade, and power. I will briefly describe each of these elements, building on Raworth’s theoretical pillars. It is notable that the Embedded economy is the foundation of ecological economics

which, differently from linear mainstream economy, “theorize the environment as the context of human existence -rather than merely an ensemble of economic “resources” or “externalities” to be factored into economic modeling (as is the case in environmental economics)” (Boehnert, 2018, p. 363).

Earth, constituting the outer circle and the space in which everything is embedded, is the life-giving element and basis of our existence. The economy depends inextricably on Earth as a source -of materials, energy, etc.- and a sink for its wastes. These two fundamental roles are shaped as well, by how far we are into trespassing or respecting earth’s planetary boundaries. Therefore, there is a need to respect these thresholds. As mentioned before, there’s little doubt on how, overexploitation of natural resources has led to most challenging crisis, possibly, in the history of humanity: climate change. The latest The Intergovernmental Panel on Climate Change (IPCC) report has categorically called for a substantial switch in energy policies: we must accelerate the global transition to clean energy and reach “net zero” emissions as soon possible and remove some of the carbon that’s already in the atmosphere. This is a notable proof of how planetary boundaries have been trespassed: if the current rate of greenhouse gases emission is sustained, the increase of 1.5ºC temperature will be reached in only 8 years. But as the latest IPCC report shows, we’ll not only need to cut out emissions—we’ll have to remove some of the carbon that’s already in the atmosphere (Pörtner et al., 2022).

Society as a foundational element, so its connections should be nurtured. Trust and reciprocity relations result in social capital, social cohesion and support networks. This helps humans to meet basic needs such as participation, protection

and belonging. As Putnam (2000), pointed out: “social capital makes us smarter, healthier, richer and better able to govern a just and stable democracy”. Whereas economy depends on the norms, trust and reciprocity in a society, the society is also shaped by the structures that the economy builds and fosters: the types of relationships it builds or weakens, the wealth distribution it generates.

Economy as a tool to pursue well-being or an inequality trigger, so it should be diverse. An economy that allows different economic dynamics to happen (moving from the pro-growth biased dominant paradigm), so all its systems should be supported: household, market, the commons, and the State (Raworth, 2017).

The household is a core concept of economy so its value must be recognized. As feminist economists have proven without the household, there won’t be any production force. Unpaid work (unpaid care work, reproductive economy, love economy, second economy, etc.), which has been skipped and undervalued in mainstream economies, is what makes them function. Household provision of care is vital for human well-being and productivity in the economy. The unpaid tasks that sustain the essentials of family and social life, are performed in its majority by women. Overlooking this fact, forces women to stop participating in the paid economy, undermines their well-being and empowerment, contributing to inequality, social stress, and vulnerability (D’Alessandro, 2016; Raworth, 2017).

Market is a fundamental component of economy. While Raworth holds a strong criticism to the way in which markets operates, she claims that “attempting to run an economy without [market] will lead to short supplies and long queues. But

when the market is unconstrained, degrades the living world by over-stressing Earth's sources and sinks on which markets depend leading to a failure to deliver essential goods and therefore widening of social inequalities and generating economic instability" (Raworth, 2017). This is why market power should be "embedded within public regulations, and within the wider economy, in order to define and delimit its terrain" (Raworth, 2017).

Another fundamental element is the *State*. It has a vital role, that goes beyond regulating interactions but to provide public goods that deliver for all, not just for those who can pay, enabling a society and its economy to thrive. States guarantee security for citizens, provide essential services, and promote economic exchange by fostering stability which in turn promotes predictability which is the basis for investment. In doings, states are based on social contracts with citizens. Second, states should "support the core caring role of the household (children care, paternity leaves, investment in early years education, care support for seniors) and third enable their collaborative potential and protect them from encroachment and fourth, harnessing the power of the market by embedding it in institutions and regulations that promote the common good (banning toxic pollutants and insider trading to protect biodiversity and workers' rights). It has also to step into the center of the stage. The state, not the market, turns out to have been the innovating, risk-taking partner dynamizing in private enterprise, as Mazzucato in his 2013's book has shown (Raworth 2017).

The state can be empowering, enabling economic partnerships but as Raworth highlights by citing Daron Acemoglu and James Robinson (2012), this

depends on whether the state's economic and political institutions are inclusive or extractive. The former are those in which the decision making is held by many people, whereas the extractive ones privilege only a few and allow them to exploit and rule over others. In order to avoid both, state authoritarism and market's fundamentalism, democratic politics are key "thus reinforcing the foundational role played by society in generating the civic engagement needed for participation and accountability in public and political life" (Raworth, 2017, p. 86).

Raworth (2017) argues that, far from simply lending out savings, banks create money as credit. Far from promoting stability, financial markets inherently generate flux. Banks create money from nothing when issuing loans – recording them both as liability and a credit. On the other hand, financial markets do not tend to promote economic stability. As an example, she mentions the financial deregulation which in 2004, as US Secretary of the Federal Reserve Alan Greenspan said was supposed to 'not only have individual financial institutions become less vulnerable to shocks from underlying risk factors, but also the financial system as a whole has become more resilient.' By the 2008 financial crash, this claim was disproved, as was "Eugene Fama's efficient-market hypothesis – that financial markets are inherently efficient. Hyman Minsky's financial-instability hypothesis – that financial markets are inherently volatile – ". In many places, financial elite have come to dominate the public good of money production. Therefore, a change and redesign in finances is needed so that it flows in service of the economy and society. One of the many examples of this redesign in finances is that state owned banks use money from the central bank to channel substantial low or zero interest loans into investments for

long-term transformation, such as affordable, adequate, and carbon-neutral housing and public transport.

Regarding business, Raworth firmly believes that “operating within the realm of the market, business can be extraordinarily effective in combining people, technology, energy, materials and finance to create something new” (Raworth, 2017, p.88). According to her, what the neoliberal discourse has ignored, by saying that the market is the key to efficiency in business is what goes inside them. Power is always at play between a firm’s waged workers and its shareholding owners because of the vast inequalities between them. She proposes two main ways to offset this power imbalances: ensuring workers’ rights to organize and bargain collectively and changing the ownership structure of the firm itself going from conventional firms with shareholders to cooperatives.

On the other hand, relative to trade, Raworth recognizes the positive effects of trade while criticizing the harming mechanisms. Globalization and the cross-border flow of commodities and services, foreign investments, and human migration that had brought, can deliver benefits but also carry risks. For example, when importing is cheaper, whereas it benefits consumers, undermines domestic markets, affecting producers and retailers and making countries more vulnerable to international price hikes -as happened in the bread riots in Africa when global prices of cereals trebled during the crisis of 2007-2008 (Raworth, 2017). Likewise, financial inflows, can boost emerging economies but when they exit too fast, can lead to a near collapse in currency. These are some reason why cross-border flows are always double-edged and so need to be managed. Raworth cites Ha-Joon Chang

by saying that however, today's high-income countries are 'kicking away the ladder' that they once climbed, recommending that low- and middle-income countries open their borders to follow a trade strategy that they strategically avoided themselves (Chang, 2010b in Raworth, 2017). In the same way as there is no real free market, there isn't free trade: "all cross-border flows are set against the backdrop of national history, current institutions, and international power relations […]. It requires effective cooperation among governments to make sure that the benefits of cross-border flows are widely shared." (Raworth, 2017, p. 90).

So far, the current pro-growth economic model in place globally has overseen its impact in inequity, since this aspect features only as a peripheral concern in the world of equilibrium economics. Given that markets are efficient at rewarding people, theorists sustain, then any differences in economic success must be due to differences in effort, and that provides a spur for innovation and hard work, the so call meritocracy myth (Sandel, 2021). But in the unbalanced world that we inhabit – where powerful reinforcing feedbacks are in play – virtuous cycles of wealth and vicious cycles of poverty can send otherwise similar people spiraling to opposite ends of the income-distribution spectrum. It's due to what systems experts have come to call the 'Success to the Successful' trap, which kicks off when the winners in one round of a game reap rewards that raise their chances of winning again in the next. Equilibrium theory acknowledges that reinforcing feedbacks might sometimes prevail in business, resulting in oligopoly – the rule of the few – but it presents these cases as exceptions to the rule. Since the 1980s, complexity economists have been developing alternative approaches including 'agent-based' modelling which starts

out with a diverse array of agents all following a simple set of rules as they continually respond and adapt to their surroundings. Getting into the safe and just space requires reversing these widening gaps of income and wealth, so finding ways to offset and weaken the Success to the Successful feedback loop will be key.

One of these ways is “designing to distribute”. Rather than accept growing inequity as a law of economic development, an inevitability that must be endured, twenty-first-century economists will regard it as a failure of economic design and will seek to make economies far more distributive of the value that they generate. Instead of focusing primarily on redistributing income earned, they will aim to redistribute wealth too – especially the wealth that comes from controlling land, money creation, enterprise, technology, and knowledge. And instead of focusing on market and state solutions alone, they will also harness the power of the commons. This vision appropriately addresses the vulnerability of socio-economic systems because it focuses on reducing vulnerabilities instead of promoting linear growth.

Nurture human nature

Raworth offers her view of our nature: she describes the complexity of human beings in terms of several topics, basing her perspectives on the view of Adam Smith. Humans are social and reciprocating; we have fluid values instead of fixed preferences; we approximate but not calculate and last but not least, far from dominating nature, we are embedded in the web of life. Raworth (2017) cites Smith’s reflections on human nature when she talks about self-interest. Self-interest is combined with concern for others and their diverse talents, motivations and

preferences, producing a complex moral character making human behavior difficult if not impossible to predict. *Homo sapiens* are cooperative living beings, which can be because cooperation increases our chances of survival. According to economists Sam Bowles and Herb Gintis, we practice what is known as 'strong reciprocity': we are conditional cooperators (cooperating as long as others do too) but also altruistic punishers (ready to punish defectors and free riders even if it carries a personal cost). The combination of these features leads to large-scale cooperation in society (Raworth, 2017). And it is the combination of these two traits that leads to the success of large-scale cooperation in society.

Across diverse cultures, social norms of reciprocity clearly vary according to the structure of the economy, particularly the relative importance of the household, the market, the commons, or the state in provisioning for society's needs. People's sense of reciprocity appears to co-evolve with their economy's structure: a fascinating finding with important implications for those aiming to rebalance the roles of the household, market, commons, and state in any society.

This integration of human nature into reflections on economic development is important because it recognizes the significance of agency within development models. While this element of the Doughnut does not directly address the conceptual objectives of this dissertation because this research focuses on SES as units of analysis, it is important to the implementation of antifragility as a mechanism for change which is introduced below. Rather than simplistically viewing governance and policy implementation in institutional terms, this dissertation examines policy communities defined as associations of political actors working to achieve like-

minded policy goals (see Häbel, 2020). This dissertation operationalizes antifragility in three dimensions: policymakers, policy entrepreneurs and citizens in order to incorporate this reflection on the importance of agency.

Get savvy with systems

Despite the mainstream conception of economy in which the central thesis is the equilibrium point is reached at a certain moment between the offer and the demand (general equilibrium theory by Kenneth Arrow and Gerard Debreu in 1954 -in Raworth, 2017), Raworth argues that “thanks to the interdependence of markets within an economy, it is just not possible to add up all individuals’ demand curves to get a reliable downward-sloping demand curve for the economy as a whole. And without that, there is no promise of equilibrium”. Looking back on historical events that disrupted the economy, it is evident that this isn’t new, in the 1970s several theorists realized that the foundations of equilibrium theory didn’t hold up. But the implications of their insight (known as the Sonnenschein–Mantel–Debreu conditions) were so devastating for the rest of the theory that this fact seem to be ignored which left ever since all economists unaware that anything was wrong with the equilibrating pulleys and pendulum of the market mechanism (Raworth, 2017).

Looking back over the last three hundred years of scientific progress, while simultaneously looking forward at the challenges facing the world, Weaver clustered together three kinds of problems that science can help us to understand. At one extreme lie problems of simplicity, involving just one or two variables in linear causality like Newton’s laws of classical mechanics. At the other extreme, are

problems of disordered complexity involving the random movement of billions of variables and these are best analyzed using statistics and probability theory. In between these two branches of science, lies a vast realm: problems of organized complexity, involving numerous variables that are 'interrelated in an organic whole' to create a complex but organized system (Weaver, 1948). The complexity of systems thinking lies in three concepts: stocks and flows, feedback loops, and delay. If stocks and flows are a system's core elements, then feedback loops are their interconnections, and in every system at least two kinds of feedback loops exist: reinforcing (or 'positive') feedback loops and balancing (or 'negative') ones. If reinforcing feedbacks are what make a system move, then balancing feedbacks are what stop it from exploding or imploding. In this sense, these feedback loops and reinforcing loops, such as environmental and social processes, were previously treated by economists and theorists as 'externalities' and in the twentieth-century theory have turned into defining social and ecological crises in the twenty-first century. "Far from remaining a peripheral concern 'outside' of economic activity, addressing these effects is of critical concern for creating an economy that enables us all to thrive" (Raworth, 2017, p. 143). This reflection is a fundamental ethical basis of this research which contends that crisis is inherent to global economic systems and local models of development should reinforce communities against them. By doing this, communities can become less vulnerable and better prepared to deal with hazards of any kind.

The dynamics of climate change

The systems perspective makes clear that the prevailing direction of global economic development is caught in the dynamics of growing social inequality and deepening ecological degradation. The globalized economy is divisive and degenerative by default, a transformation to distributive and regenerative economy is needed. A distributive economy is one whose dynamics tend to disperse and circulate value as it is created. A regenerative economy requires people participation in regenerating Earth's life-giving cycles thriving within the planetary boundaries.

Rather than aiming to predict and control the economy's behavior, says Eric Beinhocker (2012), economists should 'think of policy as an adapting portfolio of experiments that helps to shape the evolution of the economy and society over time'. It's an approach that aims to mimic the process of natural selection, often summed up as 'diversify–select–amplify'. Diversify strategies, select the ones that work and scale them up. This kind of adaptive policymaking is crucial in the face of today's ecological and social challenges because, as Elinor Ostrom put it, "we have never had to deal with problems of the scale facing today's globally interconnected society. No one knows for sure what will work, so it is important to build a system that can evolve and adapt rapidly" (Ostrom, 2012). Agents of change must learn to find the 'leverage points', as named by Donella Meadows (Meadows, 1999)– those places in a complex system where making a small change in one thing can lead to a macro transformations system-wide. Effective systems have a healthy hierarchy, self-organization, and resilience. First, healthy hierarchy is when nested systems serve the greater whole of which they are a part, for example, ensuring that the financial sector is in service to the productive economy, which in turn is in service to

life. Second, self-organization is born out of a system's capacity to make its own structures more complex, like a dividing cell, a growing social movement, or an expanding city. In the economy much self-organizing goes on in the marketplace through the price mechanism – that was Adam Smith's insight – but it also takes place in the commons and in the household too – the insight of Elinor Ostrom (and generations of feminist economists). Lastly, resilience emerges out of a system's ability to endure and bounce back from stress, resilience is therefore, the result of the dynamic balance of positive and negative feedback loops and multiplicity. Building diversity and redundancy into economic structures enhances the economy's resilience which is vital for the mitigation of vulnerabilities in SES. *n to distribute*

The focus of economic policies and development strategies should be on redistributing income earned, but also in the redistribution of wealth too – especially that coming from land control, money creation, enterprise, technology, and knowledge. Rather than promoting market and state solutions alone, the power of the commons must be harnessed. This can be done by addressing unequal access to land, promoting a fairer competition in terms of enterprises and technology and socializing knowledge through for example, guarantying open access principles and freeing patents of assets that will be benefit a larger amount of the population, rather a small number of shareholders in big companies.

Thomas Piketty's 2014 work showed that the returns to capital have tended to grow faster than the economy, leading to a higher concentration of wealth. He distinguished between two kinds of households: those that own capital – such as land, housing, and financial assets which generate rent, dividends, and interest –

and those households that own only their labor, which generates only wages. In Piketty's words, "Capitalism automatically generates arbitrary and unsustainable inequalities that radically undermine the meritocratic values on which democratic societies are based" (Piketty, 2014, p. 9). This reflection is relevant to this research because it acknowledges the relevance of substantive justice for procedural justice. As inequality grows, so does disenfranchisement. This further justifies the need to promote SES resilience by reinforcing social policies and environmental conservation. In doing so, local communities be better protected from shocks, but they will also be characterized by more cohesive political agency.

Why inequality matters?

In fact, societies can be deeply undermined socially, environmentally and politically, by income inequality. Epidemiologists Richard Wilkinson and Kate Pickett (2009) studied a range of high-income countries in 2009 and discovered that it is national inequality, not national wealth, that most influences nations' social welfare. More unequal countries, tend to have more teenage pregnancy, mental illness, drug use, obesity, prisoners, school dropouts, and community breakdown, along with lower life expectancy, lower status for women, and lower levels of trust. "The effects of inequality are not confined to the poor", they concluded; "inequality damages the social fabric of the whole society" (Raworth, 2017, p. 171). More equal societies, be they rich or poor, turn out to be healthier and happier. Democracy, too, is jeopardized by inequality when it concentrates power in the hands of the few and unleashes a market in political influence. Higher levels of national inequality, it turns out, also tend to go hand in hand with increased ecological degradation (Raworth, 2017).

An economy that is distributive by design is one that helps to bring everyone above the Doughnut's social foundation. To do so, however, it must alter the distribution not only of income but also of wealth, time and power. What design principles can nature's thriving networks teach us for creating thriving economies? In two words: diversity and distribution.

As Goerner point out: 'Because we have over-emphasized large-scale organizations, the best way to restore robustness today would be to revitalize our small-scale fair-enterprise root system,' they conclude. 'Economic development must become more focused on developing human, community, and small-business capital because long-term, cross-scale vitality depends on these.' The question, then, is how to design economic networks so that they distribute value – from materials and energy to knowledge and income – in a far more equitable way (Goerner, 2015). These considerations recognize that SES are not inherently vulnerable, but they are made vulnerable by power discrepancies (Ahmad et al., 2020). A socioecological safe and just space cannot be established until these discrepancies have been addressed and mitigated.

Redistributing income – and redistributing wealth

Of course, global development has witnessed the establishment of welfare policies aimed at mitigating vulnerabilities and power discrepancies. In the latter half of the twentieth century, policies aimed at national redistribution fell into three broad categories: progressive income taxes and transfers; labor market protections such as a minimum wage; and providing public services such as health, education and social housing. To tackle inequality at root democratizing the ownership of wealth is

needed, according to Alperovitz in 2015 (Raworth, 2017) because “political-economic systems are largely defined by the way property is owned and controlled”. So, besides redistributing income, the focus shifts towards redistributing sources of wealth too. There are clearly many ways to share more equitably the wealth that lies beneath our feet. Ostrom pointed out that there is no panacea for managing land and its resources well: neither the market, the commons, nor the state alone can provide an infallible blueprint. Approaches to distributive land design must be suitable to the people and the territory, and will work best when they combine market, commons and state approaches to provisioning (Ostrom et al., 2007 in Raworth, 2017). SES in the safe and just space are the result of policies that address the unequal access to land, accounting the need to have transparent and fair mechanisms to meet the everyone’s right to land, strengthening the power of commons to best manage collective resources and regulate the market so it does not counteract these principles. The aforementioned measures contribute to social equity, tackling structural conditions that lead to marginalization and vulnerability.

Create to regenerate: circular economy as a first step

The final principle in the Doughnut which is relevant to SES resilience is the promotion of circular economy because it is regenerative by design. It harnesses the endless inflow of the sun’s energy to continually transform materials into useful products and services. It runs on renewable energy – from solar, wind, wave, biomass and geothermal sources – eliminating all toxic chemicals and, crucially, eradicating waste by design. It does so by recognizing that ‘waste equals useful resources’: instead of heading for landfill, the leftovers from one production process

become the source materials for the next. In a regenerative economy, that material throughflow is transformed into round-flow (Raworth, 2017). This obviously addresses ecological problems associated with surpassing the earth's environmental ceiling.

Raworth, citing her personal communication in 2016 with Muirhead, one of the promoters of the Open Source Circular Economy movement, says that he states that circular manufacturing should be open source because the principles behind open-source design are the best fit for the circular economy's needs. These principles include modularity (making products with parts that are easy to assemble, disassemble and rearrange), open standards (designing components with a common shape and size); open source (information disclosure on the composition of materials and how to use them); and open data (documenting the location and availability of materials) (Raworth, 2017). These reflections address the complexity of this point. The establishment of circular economy is not simply the promotion of new production processes. The circular economy approach requires re-thinking power relationships and their relevance for the regulation of capitalism. In fact, this reinforces Ha-Joon Chang's (Chang, 2010a) contention that no markets are truly free in capitalism. This highlights the importance of defining development strategies that promote resilience overgrowth. For this reason, this dissertation identifies two foundational bases for the establishment of the safe and just space: normative coherence for sustainable development and antifragility. These concepts are addressed in the sections that follow.

Normative Coherence for Sustainable Development

The literature review in chapter one has established how Policy Coherence for Development, and its successor, Policy Coherence for Sustainable Development (PCSD) have often been proposed as means to prioritize sustainable development, especially in relation to the 2030 Agenda for Sustainable Development (2030 Agenda). PCD was first proposed to ensure that non-development policies do not undermine development objectives (Organisation for Economic Co-operation and Development., 2005). PCSD, which has been included in the United Nations' 2030 Agenda for Sustainable Development as part of Target 17.14, focusing on governance of sustainability partnerships for achievement of the SDGs (United Nations, 2015) promotes a "whole of government" approach to the pursuit of sustainable development objectives (Organisation for Economic Co-operation and Development, 2019).Zeigermann, (2020) illustrates how inclusion of PCD in the SDGs resulted from transnational policy entrepreneurship which integrated a plurality of stakeholders.

Having said this, numerous scholars have been critical of both PCD and PCSD in practice sustaining that these policy approaches have not had significant impact for sustainability. Scholars such as Carbone (2008) and Siitonen (2016) have shown how PCD and PCSD were implemented more as technical requirements than tools for transformative change. Other observers have identified numerous other difficulties with PCD/PCSD implementation. Koff and Maganda (2016) examined European Union development cooperation projects related to water and showed how PCD was implemented to foster project efficiency, but it neglected normative impact as the EU did not support Human Right to Water and Sanitation impacts. Similarly,

Koff's work on EU development cooperation in relation to migration politics (2017 and 2020) clearly indicates how the EU prioritizes securitization which actually undermines sustainability in global migration governance. Häbel and Hakala (Häbel & Hakala, 2021)also show how the EU's energy policies are not fully coherent with the organization's own sustainability principles.

A number of authors have opened this black box of incoherent norms and attempted to explain the lack of PCD/PCSD impact. Häbel's (2020) ground-breaking work on PCD in EU–Vietnam relations showed how different policy communities (development, political, and trade) interpret and appropriate norms according to their own agendas and priorities, thus undermining the overall normative commitments in inter-regional relationships. This occurs because norms are vaguely defined and not forcefully integrated into policy frameworks, which permits actors to reshape norms according to their incentive structures. Koff, Maganda, and Kauffer (2020) show how regional norms in Central America are undermined by member states which formally support them but use "non-decisions" as a way to avoid implementation and maintain status quo. These studies highlight the interaction between the relevance of norms and the agents of norms in PCD discussions. Agents often undermine intentions in global affairs.

Such situations have generally undermined the impact of PCD/PCSD. Authors such as Mbanda and Fourie (2020), Koff and Maganda (2019), Larsson (2018) and Koff, Challenger, and Portillo (2020) have documented "Northern bias" in PCD/PCSD. Thede (2013) goes so far as to argue that PCD maintains power

imbalances in global affairs by promoting visions of development that aim to promote stability of power hierarchies in international politics.

It is against this background that normative coherence for sustainable development has emerged as a response to these criticisms of PCD/PCSD, As stated in chapter one, norms are codified values. Like PCD/PCSD, norms are often considered to be strategic rhetorical commitments rather than tools for transformative change (see Šehovic´, 2019), leading to ineffective or insufficient implementation (Nhengu, 2020). NCSD argues that norms must be mainstreamed, including implementation within and across policy spheres in order to foster transformative development as defined in the SDGs (Koff & Häbel, 2022). which is less about problem-solving and more focused on the promotion of normative visions for development. Sheehy and Feaver (2015) recognize that all regulatory systems have both positive and normative dimensions. The positive dimension addresses the implementation of policy choices. The normative dimension affects the overall design of the regulatory system. These authors correctly argue that a normative regulatory framework that is incoherent will ultimately fail because the resulting policies and practices will undermine each other, leading to wasted resources and, more importantly, failure to achieve the intended governance objectives. This position reflects that of Brand, Furness and Keijzer (2021) who contend that the fundamentally incompatible political interests which shape global development cannot be managed away. This explains why growth-based development strategies tend to undermine the establishment of a safe and just space and undermine SES integrity.

Sheehy and Feaver (2015) provide an important approach to normative coherence in legal systems. First and foremost, they recognize coherence as a relational quality. According to the authors: “As a relational quality, coherence has been referred to as a property that emerges when the linkages between both similar and distinct classes of legal concepts (norms, principles, values or ‘units of analysis’) align conceptually with minimal friction or logical inconsistency.” (Sheehy & Feaver, 2015, p. 397). Based on this consideration, Koff et. al. (2022) constructed a methodological approach for the examination of NCSD in legal frameworks. The implementation of NCSD in this study is based on these reflections. This research utilizes these methods (see chapter three for full explanation) in order to examine how coherent development policy frameworks in Veracruz are with the safe and just space. Normative Coherence for the safe and just space is considered a fundamental pillar for protection of the Doughnut because it analyzes how coherent policy definition is with the safe and just space.

Normative Coherence for Sustainable Development (NCSD) “examines non-development policy arenas and their impacts on the normative objectives of sustainable development strategies” (Koff, 2020). These norms are observable in the constitution, laws, official rules and ultimately in programs and subsidies operation guidelines. Normative Coherence for Sustainable Development is both a mechanism and an analysis tool to identify mainstreaming in policy analysis, which refers to mutually reinforcing relationships between laws and values (Koff et al. 2022). This dissertation aims to contribute to the literature on policy analysis for

resilience. It then engages Antifragility as a conceptual approach for analysis of policy implementation.

Antifragility

As mentioned in chapter one, antifragility goes beyond resilience: things in a system do not stay the same, but they change. Antifragility, as originally conceived by Taleb (2014) opens the possibility to improve the functioning of a system and do so while facing shocks. Therefore, I believe that the antifragility approach is useful to face the complex and intertwined challenges that humanity is facing pandemics, climate change crises, and economic and energetic crises, amongst others. As Taleb's (2012) conceptualization of antifragility establishes, it is shocks that can trigger the change needed for systems to be coherent for the safe and just space.

Antifragility shares a set of characteristics with resilience theory, complex adaptive systems theory, and social-ecological systems theory. Building on these theories I contend that antifragility is the means for enabling the safe and just space in terms of policy implementation. Therefore, governance and policy communities' responses should be diverse, interconnected/have systems thinking, be flexible, and show polycentric governance which are the key characteristics proposed by Taleb for antifragility**.**

Policy reactions, complementary to antifragile should be responsive, addressing the immediate challenges of finding viable solutions in the short term, and at the same time not undermining their mid and long-term effects by falling into

the “short-term thinking” trap. In the same way, we believe that there are some reactive strategies, promoted by policies, that can harm human rights, and environmental protection and should be avoided (Schott, 2013). As Wilches-Chaux (2017) points out, any intervention to solely prevent non-desirable effects will be sterile, any action should have positive results in the short term and continue to have it in the mid and long term because it should address the improvement of, for example, the living conditions in a community. The purpose of this section is to describe how the core principles and characteristics of antifragile systems can be integrated into governance structures and enhance balanced SES, thus redirecting development into one aligned with the Doughnut Model.

An antifragile system as it is understood in this chapter encompasses the before-mentioned characteristics. The purpose of integrating these characteristics coming from several theories in the field of sustainable development field is to enrich the existing conceptualization of antifragility, making it more comprehensive, less institutionally centered, and easier to grasp and address in the implementation arena.

Several authors recognize that social, economic, and natural systems (or as understood in SES, system components) experience inherent volatility (Gunderson & Holling, 2002; Taleb, 2012). Volatility is due to small variations that are big enough to trigger progressive adaptation and learning, but not too big to stress the system to a point where the capacity of learning is overshot. In a forest for example, when variations in environmental conditions occur, such as little changes in humidity, sun exposure, or temperature, species with a fast exponential growth will benefit from

this and proliferate (rapid growth stage according to Panarchy theory), later leaving space to other strategies of growth, during these stages in which small variation occurs, skills are accumulated in form of learning, which will be later translated into adaptation. With continuous variation, the system continues learning and accumulating knowledge which is translated into adaptation. On the other hand, variation is one of the sources of evolution: the adaptation strategies (behavioral and physiological) of individuals are stored in their genetic material and transferred to their descendants, going beyond the life of the organism, and contributing to collective adaptation (Taleb, 2012). This is what epigenetics have studied. In wide terms, variation is needed as it can trigger evolutionary mechanisms and behavioral changes (Rey et al., 2020b). In other words, variation is needed to some extent.

Related to the idea of volatility and variation is the notion of diversity and diversification. In natural systems, diversity is linked to health. Diverse organisms can perform different functions needed to sustain an ecosystem, every organism has a niche, a space which by covering its specific basic needs for food, housing, and reproduction, acts contributing to the overall functioning of the ecosystem. In economic and social terms something similar happens, at the individual and the collective level diversity and diversification is necessary: an economic system relying on a single trade market or assent is more susceptible to crash. A society in which all individuals perform the same job and rely on the same economic sector is likely to fail. Whereas specialization is also needed, too much specialization is harmful. Underlying an antifragile system is the notion of balance between this too.

In antifragile social-ecological systems balance is mainly about how the tradeoffs between their desired characteristics result in a balanced state. SES are composed of a rich universe of components interconnected in different scales and arenas. Interconnectedness means that species, processes, institutions, and actors, amongst others, are interlinked. In any SES there are a multitude of processes going on simultaneously but at distinct paces. Some processes occur at a slow pace, which is reflected in variables slowly moving.

Therefore, any change in a variable has cascade effects, but since there's nonlinearity, a deep knowledge, or at least acknowledging these dynamics is desired to intervene in the SES. Only by accounting for the complexity of the SES, one can try to reach a balanced antifragile state. This is vital to prevent non-desired side effects of policy interventions. What might seem to be an appropriate action in present times, can result in damage if we do not acknowledge all the interconnected processes and the different time scales in which they operate. The notion of interconnectedness and complexity has been also acknowledged as necessary for the design of public policies, as highlighted by the OECD in the report "System Approaches to Public Sector Challenges". The OECD calls for action using systems thinking in policies. This responds to the key concern of "how best to account for uncertainty while managing greater complexity and still delivering effective services" (OECD, 2017).

Flexibility now becomes vital. As Holling and Meffe (1996) once wrote: "Management has to be flexible, adaptive, and experimental at scales compatible with those of critical ecosystem functions and social processes."(Holling & Meffe,

1996, p.333). The call then is for flexible institutions and policies. Flexibility in this sense means that the policies are contextually designed and that their goals, and mechanisms are adjusted to changing constraints and opportunities (Pierre, 2012). This implies the creation or modification of structures and processes to allow this. Flexibility-enabling mechanisms include platforms of dialogue between different stakeholders, in which urgent and local problems derived from a misaligned policy implementation can be solved. Nevertheless, this should happen in a transparent horizontal, and formal way, to prevent opacity and corruption.

Another characteristic for which resilience and antifragility approaches advocate is the decentralization of decision-making processes, and therefore, polycentric governance: transfer of powers and responsibilities from the central government level to the sub-national level (regional governments, municipalities, etc.), having some degree of autonomy (OECD, 2019). This is suggested as a way to reduce fragility and increase the ability to respond quickly to a sudden change that has to be dealt with. Shared responsibilities and fiscal and political decentralization can work in favor of antifragility. Horizontal structures of coordination and cooperation are desirable in decentralization. This can result from inter-municipal and inter-regional cooperation. Decentralization and polycentric governance approach should be based on “dialogue, transparency, and agreements between all main stakeholders, and be part of a broader strategy of territorial development” (OECD, 2019, p.13). Polycentric governance implies a multi-level engagement of stakeholders at different levels of power, interest, and influence in decision-making processes. “The concept of polycentric governance envisages a large number of

centers of authority each generating new political 'opportunity spaces' within which resources can be acquired and deployed.[…] It provides added 'jurisdictional integrity' in that rather than just incorporating the multitude of policy jurisdictions that multi-level governance does -itself an improvement on the conventional static, jurisdictional governance framework- it attempts to interpret the structure of relationships between stakeholders that exist whilst also providing a simplified model for analysis and operationalization" (Roe, 2009, p. 46).

Despite its usefulness and relevance, antifragility has been criticized by political and social scientists. The idea of benefiting from changes results in assuming that perturbations and shocks are somehow needed to pursue a better coping system. This can result in what Cavanagh (2016) describes as contemporary processes of class formation, consolidation, and/or fragmentation illuminating how certain class strata increasingly stand to benefit from the social and ecological crises inherent to the process of uneven capitalist development.

It is repeatedly mentioned that any discussion of social-ecological resilience or antifragility will inevitably remain vacuous without considering the politics of precisely who retains the capacity for resilience, much less antifragility, at the expense of whom, and why: in other words, of its class politics. The issue of ownership, responsibility, and absorption should be part of the discussions. Nevertheless, without questioning if Black Swans (defined as large-scale events that are unpredictable, irregular, and with a wide range of undesirable and prejudicial effects for the systems that weren't unable to see them coming- Taleb, 2012) are something desirable, I acknowledge that they exist: big external hazards that will have

deleterious consequences in the very short term, but I believe that what must get more attention is how the system is configured in a way that these shocks are unevenly absorbed.

Normative Coherence for Sustainable Development and Antifragility for a Safe and Just Space

The first section of this chapter explained why the safe and just space is such an important concept for the maintenance of social-ecological systems. This concept represents the balance needed to maintain SES integrity which addresses the needs of communities while preserving environmental conditions.

Doughnut Economics has been recognized globally as an innovative conceptualization of sustainable development. The question it raises asks how can it be implemented. This dissertation contends that normative coherence for sustainable development and antifragility can be used together to achieve the Doughnut's foundational principles.

This chapter presents these principles above. They begin by focusing on visions for development. Specifically, Raworth (2012) proposes two important points on which her work is based: "change the goal" and "see the big picture." By focusing squarely on the normative dimension of policymaking, NCSD respects these arguments. This approach prioritizes a specific vision of sustainable development that aims to mitigate social-ecological vulnerabilities. It promotes a balanced vision of development that aims to achieve social equity and environmental conservation. In doing so, it changes the pro-growth development narrative, embracing

development visions that challenge this narrative while proposing alternative economic paths (see the circular economy, post-growth, and el buen vivir models). It also pursues the embedded economy which Raworth proposes within her discussion of “see the big picture.” NCSD aligns with the principle of the embedded economy by recognizing the fundamental role of all the elements that intervene in the economy. For example, it does so by acknowledging the importance of gender equality -as women are the pillar of most households- by promoting women's access to education, health, and job opportunities, as well as access to financial resources. Women’s inclusion in the job market, in conditions of equity, has the potential to nurture the economy. NCSD also addresses two other principles of Raworth: “address inequality” and “address climate change.” This approach laces these topics at the center of development strategy discussions and examines mainstreaming of policies to achieve both of these goals.

Antifragility also promotes Raworth’s Doughnut model by structuring policy implementation. The concepts focus on diversification and interconnectedness is highly relevant for “Get Savvy with systems” and “create to regenerate.” Acknowledging the diversity of stakeholders in governance systems and decision-making alongside promoting diverse mechanisms of agricultural goods production and meeting communities’ basic needs, shows that there’s an understanding of the complexity in SES and how variety means better facing this complexity. The understanding of the interconnectivity of SES elements and process has the potential to question how the power relationships in processes range from production systems to decision-making and policy definition. This approach identifies these

characteristics of governance as key elements of policy learning meant to reinforce SES from crises. Moreover, the approaches that focus on flexibility and decentralization -expressed in polycentric governance- are relevant for “Nurture human nature” because they aim to decrease the limits of institutionalization on SES governance, therefore contributing to the potential for adaptation. Focusing on flexibility and polycentric governance can bring leverage to all the stakeholders of an SES, leading to adaptation throughout all governance levels of the SES: citizens, grassroots organizations and policy entrepreneurs, and government actors. For these reasons, this dissertation adopts the analytical framework of normative coherence for sustainable development and antifragility for the safe and just space as a means to address the complexity of social-ecological systems facing crises. This framework is operationalized further in the following chapter.

Chapter 4. Operationalization of Policy Coherence and Antifragility for a Safe and Just Space: Methodological Innovations

Use of the Safe and Just Space as a normative framework

Chapter one has argued that sustainable development by itself is a very vague principle, which is why some authors contend that it has lost normative value. Resilience is in a similar situation since it has been widely cited but at the same time vaguely defined including various heterogenous connotations. To operationalize proper responses to crises, this dissertation has adopted the Safe and Just Space proposed by Raworth, because “it requires that stocks of critical natural capital be maintained (via the planetary boundaries requirement), while at the same time requiring that stocks of critical human and social capital also be maintained (the basic needs requirement)” (O’ Neill et al., p. 89) adopting a strong sustainability perspective. Several scholars such as Hickel (2019), Dearing et al., (2014), and O’Neill et al. (2018) have recognized the leverage that the Safe and just Space brings to the field of sustainability and resilience. Besides arguing for strong sustainability, this framework addresses efficient allocation and fair distribution of resources, and power asymmetries (Daly, 1992). Therefore, the Safe and Just Space (SJS) is a comprehensive approach that encompasses a multidisciplinary perspective by building up Rockstrom’s (2009) planetary boundaries proposal and second, by bringing into the table economy, ecology, social and political sciences,

and economics, amongst others. Building on the conceptual points raised in the previous chapters, I now present the operationalization of the Safe and Just Space as a normative objective for resilience research. This chapter is important because it establishes a bridge between the conceptualization of the safe and just space and empirical research in local communities.

One of the proposed originalities of this dissertation is its operationalization of the Safe and Just Space (SJS) which has been recognized internationally as an innovative model for sustainability. Hickel, Dearing, and O'Neil highlighted the SJS value for the implementation of the SDGs and the pathway to a different kind of development. Hickel (2019) modeled the safe and just space, acknowledging that "it calls for the world's nations to achieve key minimum thresholds in social welfare while remaining within planetary boundaries" (Hickel, 2019, p.18). Hickel's key finding is that poor nations should adopt fairer distributive policies whereas rich countries should reduce their footprints to stay within the safe and just operating space, for which they should abandon growth as a policy objective. Dearing et al. (2014) advocate for the safe and just operating space as a suitable framework for a regional implementation, contending that increases the policy impact of the planetary boundaries, contributes to the understanding of complex thinking throughout governance and policymaking and acts as a communication tool for regional equity and sustainability. Dearing et al. (2014), touch on several aspects in which they build a framework for regional sustainability assessment: complex interactions, inter-regional fluxes, and tradeoffs. While disentangling complexity to make it easier to grasp, O'Neil and colleagues (2019) recognize the value of the framework to model

and create hypotheses about links and interactions between current environmental viability and societal well-being in a region. On the other hand, all regions are connected, creating fluxes of goods, money, and ecosystem services, this means that the social and ecological variables within many regions are not necessarily strongly linked to local resource availability, something that should be studied deeper. While drawing attention to complex interactions and inter-regional fluxes, Dearing et al. (2014) show that there are tradeoffs between the environmental ceiling of the safe and just space and social well-being indicators, identifying some potential solutions that reduce them.

The outcomes of these studies are useful for decision-making since they highlight the tradeoffs between different scenarios touching on several concrete indicators. Nevertheless, normative commitments have received little attention in these discussions. As Koff and Häbel (2022) argue, development strategies, contained in policies, must commit to global norms, "defined as codified systems of ethics or values that emerge within policy communities to promote a collective vision for development" (Koff & Häbel, 2022, p. 3).

The Safe and Just Space, as proposed in Raworth's Doughnut model, comes with indicators and foundational principles described in chapter two. Unfortunately, it was not possible to utilize each of these categories as the basis of the analysis. However, this dissertation has adopted the Safe and Just Space by creating a category of social, environmental, and protection principles which will be described next. Each of these categories is defined for the following policy sectors: social development, environment, economy, infrastructure, governance, and security. By

establishing these categories, the dissertation operationalizes the Safe and Just Space as a normative objective. It re-conceptualizes development as a means to protect socio-economic systems from crises. The economic protection principles acknowledge that international crises affect SES in general. The social category of protection focuses on human vulnerabilities. The environmental category addresses ecological vulnerabilities (see figure 3) and the emergence of hazards.

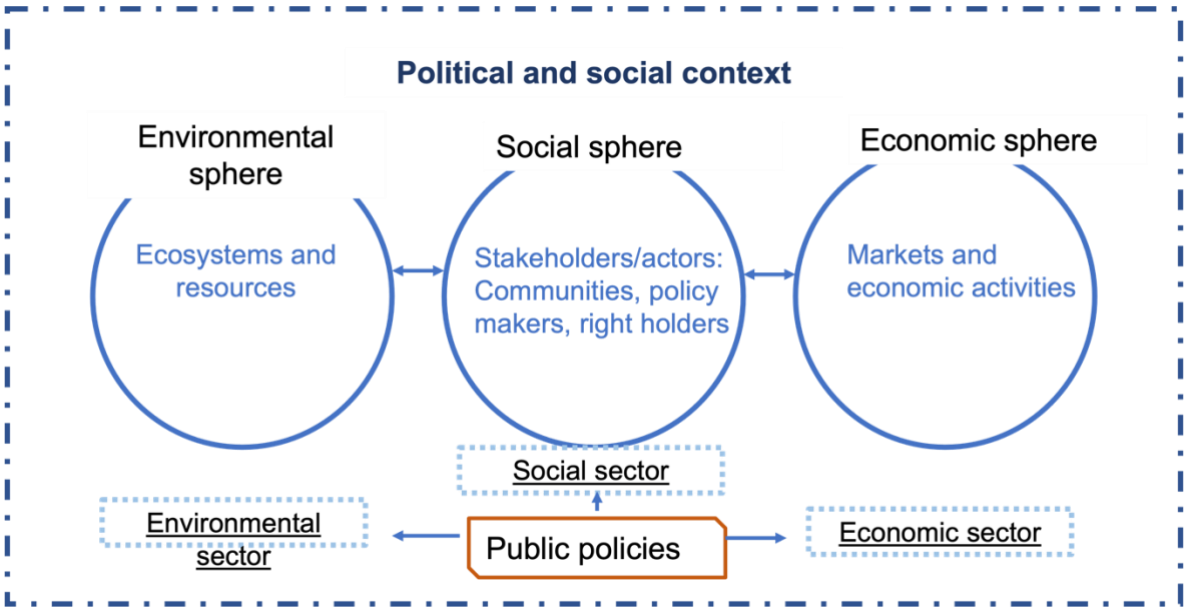


Figure 3. Representation of SES and its spheres and links with policy sectors (source: made by author).

The social category defined in this dissertation is social equity. As mentioned in chapter 1, social equity is how much commitment exists to expand the common good and minimize social divisions. Social equity, as a normative principle, encompasses several of Raworth's indicators listed in table 3 in chapter two: political voice, peace and justice, education, health, food, water, energy, gender equality,

housing, networks, and income, and work as key goals that should be expressed in public policies. As mentioned before, social equity is defined per each policy sector.

Social equity category is translated into policies that promote social integration terms of the social sector, policies should aim for social integration, and include anti-discrimination and inclusion mechanisms ensuring everyone's right to political voice and participation. This category also includes housing, food security, health, and education.

Social equity in terms of environmental policies means that natural resources and ecosystem services are equally accessible to everyone, for example, water, the right to a healthy environment, and access to other strategic resources such as land to produce food in cases in which the communities' livelihoods depend on self-consumption agricultural products, access to forest as recreational spaces, sustainable use of biodiversity to ensure communities livelihoods, amongst others.

Raworth contends that social capital is fundamental for the safe and just space since it contributes to the richness, health, and capability to govern a just and stable democracy and it is closely related to the economy, since the structures that it builds strengthen or weaken relationships in society. Therefore, the economy should be a tool to pursue well-being. Economic policies should include economic integration strategies, social capital creation as well as social protection through mechanisms such as unemployment insurance and social security programs. In terms of security policies, they must ensure that every individual is safe and has equal access to justice. To ensure that the starting conditions are as equal as

possible for everyone to meet their basic needs, as Sen contends, infrastructure policies need to focus on creating the facilities and infrastructure for basic universal service provision. Finally, governance policies must promote and provide institutionalized and legitimate spaces and systems for citizen participation and decision-making.

The planetary boundaries category includes the indicators proposed by Raworth (see table 1 in chapter 2): climate change, ocean acidification, chemical pollution, nitrogen and phosphorus loading, freshwater withdrawals, land conversion, biodiversity loss, and air pollution. Policies, not only in the environmental sector but in all sectors, should aim to keep the SES without trespassing the planetary boundaries expressed in the before-mentioned indicators. In terms of social policies, any development strategy must promote sustainable development, ensuring the provision of basic services without compromising the Earth's capacity to do it. Besides focusing on the specific indicators proposed by Raworth, environmental policies should focus in general on nature's protection and conservation as well as the earth's vital processes. Embracing Raworth's principle of regenerative, circular, and/or green economy, economic policies should promote these types of economic systems to ensure that the planetary boundaries aren't trespassed. Regarding the security sector, policies must focus on risk mitigation and vulnerability reduction through nature-based solutions, defined as "actions to protect, conserve, restore, sustainably use and manage natural or modified terrestrial, freshwater, coastal and marine ecosystems, which address social, economic and environmental challenges effectively and adaptively, while simultaneously providing

human well-being, ecosystem services and resilience and biodiversity benefits" (United Nations, 2022 in, (World Wildlife Fund, 2022)2022), and investment in green infrastructure such as restoring wetlands to buffer local communities from flood waters or conserving mangrove forests that provide nurseries for fish and protect nearby homes against storm damage to provide basic services. Economic strategies must go beyond business as usual and engage with these alternative economies. Governance policies must promote the inclusion of environmental advocates and representatives of the communities affected by resource misuse in the decision-making processes and norms against natural resource misuse and overexploitation.

The protection category is one of the originalities of this dissertation: it constitutes the "glazing" of the doughnut contending that policies should insulate the SES from shocks. Social policies should provide universal social welfare and social security. Environmental policies should enable sustainable nature conservation and ensure the transparent use of natural resources. Regarding economic policies, this category embraces the principle of changing the goal (described in chapter 2). It is translated into policies that advocate for development strategies including but not limited to economic growth, as this is not the means nor the ultimate goal of social development. On the other hand, giving value to the household is the core of the production force by promoting policies that recognize its value, such as financial support for unpaid tasks -normally performed by women allowing their development and integration into social, political, and economic life. Economic policies must protect against deregulated markets aiming to stabilize the standard of living and transparent regulation of economic markets and taxation. Security policies must

have a rights-based framework and must protect from violence and hazards. One key aspect that has been mentioned before is equal access and distribution of resources, therefore, infrastructure policies must be transparent and urban planning needs to ensure equal mobility and communication for everyone. Finally, governance policies must encompass responsive governance (for example institutional collaboration to solve emerging issues) and anticorruption and anticorruption preventive mechanisms. The normative principles for each of the three categories: social equity, planetary boundaries, and protection in the different policy sectors analyzed are summarized in table 4.

Table 4. Normative principles and keywords for each safe and just space model's category created for each policy sector (source: author's creation based on Koff et al.,2022 and Raworth, 2017).

Policy sector	Social equity	Planetary boundaries	Protection
Social development	Social integration, Anti-discrimination, social inclusion, housing, food security, health, and education.	sustainable development, development models compatible with sustainable development	Universal social welfare and social security

Environmental	Equal access to strategic natural resources/ ecosystem services	protection and conservation of population and species of fauna and flora, climate change fight, and conservation of earth's vital process	Sustainable environmental conservation; transparency on the use of natural resources
Economic	Economic integration programs, human capital creation, job training, unemployment insurance, etc.; social security measures;	Regenerative economic design and circular and green economy	Protection against deregulated/liberalized markets; economic protections aimed at stabilizing standard of living and transparent regulation of economic markets/ taxation; transparency regulation

			standardization of well-being.
Security	Security for all, social justice	Risk mitigation and vulnerability reduction; nature-based solutions	protection from violence and hazards; Rights-based security framework;
Infrastructure	Investment in an infrastructure basic for universal service provision	Investment in green infrastructure for service provision, environmentally friendly/responsible infrastructure, and nature-based solutions	Transparent urban planning; mobility and communication equal access
Governance	Establishment of citizen decision-making systems	Inclusion of environmentalist advocates in decision-making processes and norms against	Responsive governance policies and anticorruption mechanisms and systems enabled

		natural resources misuse/overexploitation horizontal decision-making;	and implemented; anticorruption, responsiveness, and preventiveness

As stated above, these characteristics of the safe and just space are the bases for the empirical research that follows. Normative coherence for sustainable development focuses methodologically on the alignment of policies with specific norms. The safe and just space acts as a normative reference for this study. The characteristics presented above in table 4 are utilized in this analysis as benchmarks. As such these characteristics represent keywords in the text analysis of policy documents. When these words are present in policy texts, they represent normative coherences for a safe and just space. When they are absent or when the texts present policy choices, they undermine these characteristics (focusing for example on growth, globalization or wealth, etc.) then these trends represent incoherences for the safe and just space. This is explained in detail in the following section.

Normative Coherence for the Safe and Just Space

As mentioned in chapter two, several authors have highlighted the importance of normative coherence for sustainable development (Kauffer & Maganda, 2022; Koff

& Häbel, 2022). Normative Coherence for Sustainable Development (NCSD) “argues that norms must be mainstreamed, including implementation within and across policy spheres to foster transformative development as defined in the SDGs” (Koff & Häbel, 2022). NCSD prioritizes transversal normative commitments in the field of sustainable development which is focused on the promotion of normative visions for development. As cited in Koff et. al. (2022) Sheehy and Feaver (2015) “argue that a normative regulatory framework that is incoherent will ultimately fail because the resulting policies and practices will undermine each other, leading to wasted resources and, more importantly, failure to achieve the intended governance objectives”. Therefore, I contend that NCSD is the most accurate tool to achieve policies for the Safe and Just Space. Scholars such as Sheehy & Feaver, 2015) and Koff et al., (2022) recognize that coherence is a relational quality. According to these authors, coherence is “a relational quality, coherence has been referred to as a property that emerges when the linkages between both similar and distinct classes of legal concepts (norms, principles, values or ‘units of analysis’) align conceptually with minimal friction or logical inconsistency.” (Sheehy & Feaver, 2015, p. 397).

For the purpose of this dissertation, norms are defined as values, such as sustainable development and/or the Safe and Just Space, that have been codified through legal documents and policies, such as local policies, programs, or development plans at different government levels. Values refer to a system of beliefs or assumptions that guide actors' behaviors(Aasen & Vatn, 2018; Koff, Challenger, et al., 2022).

Normative coherence refers to mutually reinforcing relationships between development plans and values. This was operationalized by studying alignment where the norms aligned with the normative categories in the safe and just space. Due to the scale of the unit analysis of this dissertation and the fact that development plans must guide policies at the national and state level, this dissertation examines normative coherence through the prism between objectives, strategies, and lines of actions of state development plans of Veracruz and each normative category of the safe and just space: social equity, planetary boundaries, and protection. The state development plans for Veracruz were chosen for this analysis because they are the policy documents that most influence development strategies in the state. From these documents, sectoral plans are developed that influence policy in specific arenas. This analysis encompasses the overall development plans for Veracruz because these are the documents in which the mainstreaming of sustainability norms should be found in the texts. Should sustainability norms related to equity, protection, or respect for planetary boundaries not be mainstreamed, then is little reason to expect mainstreaming to occur in sectoral policies. Time limitations also affected the decision not to include sectoral plans because the inclusion of analysis at this level would necessitate analysis of all the different state plans to investigate mainstreaming in practice. This could be the basis for future research.

Normative Coherence for a Safe and Just Space signifies the mainstreaming of the characteristics of this space. As such, normative coherence represents normative alignment which, as Koff et. al. (2022) show, examines whether the normative bases of policies mutually reinforce or clash with the dimensions of the

safe and just space. The Veracruz State Development Plans have been analyzed in terms of their coherence or incoherence with the categories created for the safe and just space (determining a positive or negative number), their indirect or direct relationship to them of the safe and just space (-1/+1 or -2/+2) and their incomplete or complete relevance for one of them of the safe and just space (-2/+2 or -3/+3). In cases where policies directly and completely reinforce dimensions of the safe and just space, +3 is assigned. In cases where policies conflict with the safe and just space directly and completely, a -3 is assigned. All other conditions represent mixed measures. These values are explained in the scale presented in table 5.

Table 5. Description of the interaction between the items analyzed and each of the categories of the safe and just space (source: author's creation based on Koff et al., 2022 and Raworth, 2017).

Interaction	Name	Explanation	Example
+3	Indivisible	Directly and completely mutually reinforcing norms for the safe and just space	Formal and substantive normative commitments to the safe and just space concerning a specific cause: include all the specific elements needed for a

			transparent and direct commitment.
+2	Reinforcing	Directly and incompletely mutually reinforcing norms for the safe and just space	Formal normative commitments to the safe and just space about a specific cause; lack the inclusion of one minor element, diminishing the level of commitment
+1	Enabling	Creates conditions that further safe and just space (indirect)	General normative discourse in favor of resilience without direct reference to a specific cause; there's a lack of a fundamental element that settles the commitment
0	Consistent	No significant	Absence of non-significative

		positive or negative interactions	normative elements in policy debates
-1	Constraining	Creates conditions that indirectly undermine safe and just space	General normative discourse undermining safe and just space without direct reference to a specific cause
-2	Counteracting	Directly but incompletely clashing with safe and just space norms (as described in Chapter II on what's behind the doughnut)	Formal normative commitments that directly reference and undermine a specific cause of safe and just space
-3	Canceling	Directly and	Formal and substantive normative

		completely clashing with just space norms (as described in Chapter II on what's behind the doughnut)	commitments that directly and completely undermine a specific cause of safe and just space

Simplifying the contention of Folke and colleagues (2006) of SES going through several phases, I created a theoretical ideal type (figure 4). The first one, which for methodological purposes is identified as T0, is an accumulation phase in which resources such as natural resources, energy, social capital, increased connections, etc. exist abundantly allowing the SES to thrive in the SJS. Natural resources are mobilized in such a way that social equity exists for human communities and at the same time the vital cycles of ecosystems are preserved. This is, of course, an ideal type. All components in the spheres of the SES are equally important and there's no overshoot of the planet's resources nor is there a shortfall of well-being. Policies in this ideal type are coherent for the safe and just space. The SES remains in a stable state with some non-significant changes until a shock or perturbation occurs.

Once this shock occurs (T1), socio-environmental systems become de-aligned. This signifies a loss in stability which can entail either social impacts that affect a community's well-being, environmental issues that cause harm to ecosystems, or both. In theory, a system that is aligned with the safe and just space should be able to minimize the impacts of external shocks or perturbations. However, this is not usually the case in the real world.

Having said this, governments do often respond to shocks with policy remedies. These strategies should react to conditions caused by crises and aim to prevent vulnerability to future crises. Socio-environmental systems then face a moment in which the links between stakeholders, and institutional and natural processes change, entering a state of re-alignment, policies align with a safe and just space in part due to learning from the crisis experienced in T1.

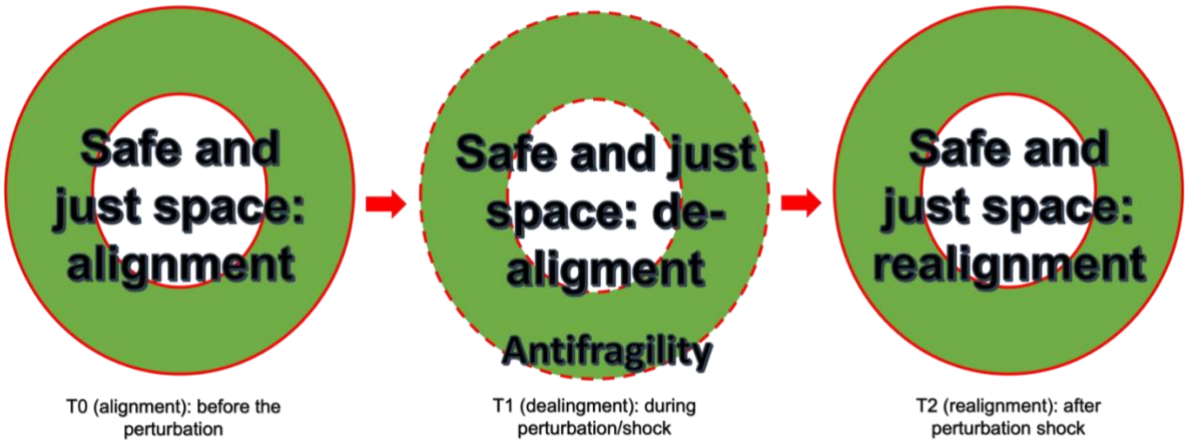


Figure 4. The three stages of Social-Ecological Systems.

For this reason, normative coherence for a safe and just space is present in T0 and T2 as reference points for analysis. T1 which aims to explain policy learning

focuses on antifragility approaches which are explained below. One of the ways that this dissertation deviates from traditional resilience scholarship is related to the issue of time in the analysis. Because resilience studies often examine how social-ecological systems return to states of equilibrium following crises, they study a return to T0 following T1. Instead, this dissertation employs the logic of antifragility that contends that systems benefit from crises, and they evolve so T1 is followed by a new state of equilibrium which is characterized by T2.

In the case of this study, the 2011 to 2016 and 2018 to 2024 Veracruz state development plans are important because they establish development strategies before and after a major shock to SES in the state. As mentioned in chapter 1, in 2012 the biggest outbreak of coffee rust happened in all the coffee-producing regions of Mexico, including Veracruz adding to the already existing vulnerability of the coffee sector. This coffee rust outbreak led to a loss of 25% in the coffee sector of Veracruz: a loss of 60 million pesos (Castilla, 2022). This led to a lower harvest than in previous years and therefore a change from arabica traditional varieties to others that are more resistant but of less quality (Escamilla Prado & Landeros-Sánchez, 2016). The rust also caused the burning of a large number of plants: 45 thousand hectares of coffee plantations were lost by 2022 (Castilla, 2022), whose reseeding would imply at least 3 years of waiting to harvest again (Batista, 2018 in Ramos Rivera et al., 2021). The rust outbreak slowed down drastically in 2018 (Escamilla y Landeros, 2016 in Hernández y Nava 2020) but according to recent reports continues to have deleterious effects in some coffee-producing regions of Veracruz (Castilla, 2022).

Normative coherence for the safe and just space is analyzed in the T0 -alignment stage- and T2 -realignment stage- to investigate whether coherence levels have changed and in what sense (improved or not). Should policy learning exist, then levels of normative coherence for a safe and just space should be higher in T2 (the 2018-2024 State Development Plan) than in T0 (the 2011-2016 State Development Plan).

In order to measure levels of normative coherence for a safe and just space the analysis of the State Development Plans was conducted at all three levels of defined objectives, strategies, and lines of action. The objectives in the plan outline policy goals for each sector described above, they set the foundation for the whole state. The strategies present general definitional specificities for the operationalization of these goals, they go into more detail about policy mechanisms and regularly follow up closely on what is set in the goals. The lines of action present implementation frameworks. This approach facilitates a comparative analysis of these plans in terms of policy definition, policy operationalization, and the definition of implementation strategies. Not only can this approach study the presence or absence of policy learning but can also pinpoint the level(s) at which this occurs or does not.

To implement this methodology, each objective, strategy, and line of action for each policy sector of the plans (Governance and political life, Infrastructure, Social Development, Economy, Environment, Security) was qualitatively analyzed in relation to a specific normative category of the safe and just space (equity, planetary boundaries, and protection). When the objective, strategy, or line of action

undermined a characteristic of the safe and just space, a negative value was assigned based on the criteria presented in table 5. When the objective or strategy reinforced a characteristic of the safe and just space, a positive value was assigned according to these same corresponding criteria. Scores were then aggregated by sector and by level. Because the number of objectives, strategies, and lines of action varies by sector, it is not possible to compare normative coherence for the safe and just space scores directly. For this reason, I divided each sector score by the potential maximum score available per sector (+3 x the total number of objectives, strategies, and lines of action). This established NCSJS coefficients which are directly comparable indicating coherence across sectors and different levels of policy definition. The same technique was used to calculate aggregate scores. First, the normative coherence for a safe and just space score is the sum of the social equity and planetary boundaries scores divided by two. This permits comparison with the normative coherence for a "glazed" safe and just space which represents the sum of the social equity, planetary boundary, and shock protection scores divided by three.

These coefficients represent the distance between the normative coherence for a safe and just space (glazed and without the glaze) of the state development plans and an ideal type. This model can and should be implemented in other contexts and applied to other types of shocks to test its comparative value.

The temporal comparative aspect of the study presents an original contribution to the literature on normative coherence for sustainable development as well. Thus far, studies in this field are relatively vague in terms of systemically comparing policy documents (see Koff et. al., 2020). Koff et. al. (2022) present a

methodology to compare documents for normative coherence for sustainable development but they do not integrate policy change in their analysis. By comparing development strategies before and after crises, this analysis aims to shed light on policy reactions to crises. Of course, this analysis only shows whether a change has occurred. It does not explain why. For this reason, this study adopts antifragility perspectives to address the bases for policy change. This is presented in the next section.

Antifragility for the Safe and Just Space

Antifragility was adopted as a policy approach to achieve the Safe and Just Space because this perspective focuses on how systems thrive through policy learning during crises. As mentioned in chapter one, antifragility goes beyond resilience: components of a system do not stay the same, but they change. Antifragility can potentially make an SES improve and do so while the shocks are happening. Therefore, I believe the antifragility approach is useful to face the complex and intertwined challenges that humanity is facing: pandemics, climate change crises, and economic and energetic crises, amongst others. Antifragility governance, therefore, is studied during the rust crisis to see how decisions were made in response to this perturbation. By adopting this approach, the analytical model proposed here aims to explain any potential shift in policy frameworks between T0 and T2.

One limitation of the literature on antifragility is that it is highly institutionalized and vertical (see Blečić & Cecchini, 2019b; Botjes et al., 2021). Policy is conceptualized as governmental regulation. This approach does not satisfactorily

integrate the complexity of policy frameworks. One proposed contribution of this dissertation to the literature on antifragility is the incorporation of policy networks into this analysis. Policy networks refer to the diverse coalitions of actors/stakeholders which mobilize in order to achieve policy change. Rogowski (1999) contended that policy competition shifted away from class divisions towards sectoral coalitions based on shared economic interests affecting industries. Similarly, change occurs at different levels as well. Most of the literature on policy coherence for sustainable development focuses on policy definition at the macro level. Suvi Huttunen (2015) instead has demonstrated how coherence has been promoted in Finland in the agriculture sector through innovative farming practices rather than policy reorientation.

So far, antifragility has been used in engineering, urban planning, and managerial sciences, focusing on a set of top-down decisions and actions (Blečić & Cecchini, 2019a; Botjes et al., 2021; de Bruijn et al., 2020; Tokalic et al., 2021). For example, Botjes and colleagues (2021), identified twenty-two antifragility attributes of organizations as key factors to ensure their survival facing unexpected shocks. This systematic analysis leading to a comprehensive list is a useful instrument since it provides insights into the characteristics of resilient and antifragile organizations. It provides attributes that are useful in designing organizations. Despite its utility as guidelines, this list can overlook the dynamics of organization governance and constrain creativity by listing, for example, some characteristics that depend on power dynamics such as skin in the game, which implies taking highly risky decisions, despite the consequences this might have.

I recognize the worth of the scholarship produced on antifragility, in the sense that it explores ways of understanding how to better respond to crises (see Blečić & Cecchini, 2019b; Botjes et al., 2021; Notarstefano, 2022) but I acknowledge the limitations of these studies when it comes to grounding antifragility in terms of governance and policy implementation in the sustainability field.

Building on the work of antifragility scholars, resilience, and earth governance systems, as defined in previous chapters, I operationalize antifragility through the definition and implementation of five characteristics: diversification, flexibility, interconnectivity, polycentric governance and finally learning, translated into policy learning. The ideal types of each of these characteristics are described in table 8. In this chapter, I have also adopted the approach developed by Koff et al. 2022 in which the authors developed a methodology to analyze sustainable development norms in Mexico's legal framework. Based on their work, I proposed criteria for understanding the relationship between each of the stakeholders' reactions and their perception of other types of stakeholders' reactions (for example, a citizen expressed in an interview their perception of how a policy entrepreneur reacted) to coffee rust and the five antifragility characteristics.

This dissertation examines these five characteristics in three levels of policy engagement. The first examines government responses to crises which represent traditional approaches to antifragility. Second, this dissertation examines policy entrepreneurs, defined as interest organizations that promote or block policy innovations through social mobilization. Third, this research addresses antifragility through practice at the grassroots level focusing on citizens. In this case, because

the study examines coffee production, the analysis presented here includes coffee producers in central Veracruz.

This research adopted a mixed methods approach and multi-site ethnography, to understand stakeholders' reactions to coffee rust in Veracruz's coffee sector and policy implementation through coffee-related policy communities in the state.

To assess antifragile governance and reactions from the government, policy entrepreneurs, and citizens, I conducted semi-structured interviews with stakeholders including those specialized in coffee sector governance and policies, government officials, members of NGOs, small, medium, and large coffee producers, and retailers, CEOs of large coffee trading companies and beneficiaries of government agricultural and coffee subsidies from Veracruz coffee producing regions. Some interviewees belonged to more than one category. Interviewees were asked to sign a consent letter in which I introduced myself and briefly explained the aim of the questionnaire as well as the criteria for data storage, use, and analysis: no personal data disclosure in the results of the dissertation and codes composed by four letters and two numbers were assigned to each interviewee.

Interviews were performed between August 2021 and January 2022. Each interview lasted between 1 hour and 2 and a half hours. All interviews were recorded (previous consent of interviewees accorded), as most of them were done remotely due to complications caused by the Covid-19 pandemic. The interviews were transcribed using Adobe Premiere © and saved as text files. After this, they were imported and analyzed using MAXQDA. The analysis consisted of critically reading each interview and identifying the five characteristics of antifragility by signaling

dynamically in MAXQDA their presence/absence and strength in the stakeholders' discourse.

This data was used to assign the scores from -1 to +1, as described in table 6. The means of the scores assigned per each category of stakeholders were calculated to locate where antifragile governance occurred and where gaps remain in that regard.

Table 6. Description of the strength scores for antifragility characteristics.

Strength of the characteristic	Name	Explanation	Example
+1	Reinforcing	Directly and completely mutually reinforcing antifragile behavior.	Direct mention of an antifragile characteristic, actions implemented that correspond to this feature
0	Absence	Omission of significative antifragile behavior.	No mention of antifragile behavior or the opposite of it.

-1	Counteracting	Directly and completely clashing behavior of an antifragile feature.	Substantive mention and implementation of the opposite of an antifragile behavior.

These scores reflect an analysis of the five characteristics of antifragility identified in chapter two: diversification, interconnectivity/complex systems thinking, flexibility, diversification, and decentralization. I have created ideal types for each characteristic to assess the decisions and reactions to the crisis at three levels of policy networks: government (policy makers), policy entrepreneurs (associations and NGOs) and, citizens (coffee producers and other agricultural producers) (table 7).

Table 7. Antifragility characteristics' ideal types for diverse stakeholders

Feature	Definition/ideal type for policymakers (government)	Definition/ideal type for policy entrepreneurs (associations,	Definition of ideal type for citizens (coffee producers)

		NGOs, think tanks, etc)	
Diversification	Promotion of multiple productive and economic strategies.	Diverse policy communities: multiple stakeholders participate in one or multiple stages of the policy cycle process.	Adoption of multiple productive and economic strategies.
Interconnectivity/Complex systems thinking embracement	policies and policy reactions considering links between social, environmental, and economic components and between policies and strategies.	Promoting the participation of stakeholders from different scales and administrative hierarchies participate in one or several stages	acknowledgment of the links between the social, environmental, and economic effects of the programs implemented

		of the policy cycle.	
Flexibility	Adapting to conditions according to the context in terms of time and territory; policies more contextually defined and the possibility of adjusting their goals and resources to changing constraints and opportunities.	They adopt and promote structures that allow changes based on dialogue and open communication with different types of stakeholders involved.	adapting strategies to conditions according to the context policies more contextually defined and the possibility of adjusting their goals and resources to changing constraints and opportunities
Polycentric governance	The less center-oriented decision-making process, diverse policy communities, shared power and resources;	Regional and local institutions have a degree of autonomy to make decisions in one or multiple	Stakeholders build trust networks and support networks with other stakeholders, decentralizing power and resources

	shared governance structures that respond to socioeconomic needs and nature conversation in terms of time and territory. This must have a legal basis and legitimacy in public administration to the shared governance structures and institutions.	stages of the policy cycle process responding to socioeconomic needs and nature conservation in terms of time and territory.	responding to their socioeconomic needs always aware of the need of preserving the earth's life cycles.

Finally, I assessed if learning happened, using the ideal types from table 8. Learning is highly relevant to antifragility for the safe and just space since it shows how the change in structures, mechanisms, and goals integrates or not new knowledge acquired during the crisis stage. For example, monitoring policy outcomes and accounting for what has been learned is vital to enhance adaptation and reduce vulnerability. Instrumental policy learning entails lessons about the viability of policy instruments or implementation designs. Learning in public policies is shown by the change in the goals and values encompassed in the design of the policies. Learning implies improved understanding, as reflected by an ability to draw lessons about policy problems, objectives, or interventions. Learning can entail a

new or reaffirmed understanding of policy problems or objectives (Smith & Larimer, 2017).

Table 8. Learning definitions for each type of stakeholder.

Feature	Definition/ideal type for Government (Policymakers)	Policy entrepreneurs (associations, NGOs, think tanks, etc.)	Definition of ideal type for citizens (coffee producers)
Learning	The change in structures, mechanisms, and policies responding to how new knowledge is integrated as a sign of learning; changes in policy goals; changes in policy goals and policy mechanisms=improvements after noticing they weren't	Changes in coping strategies, advocacy, and agency strategies; critical capacity to choose the best option based on evidence and outcomes.	changes in coping strategies; changes in coping mechanisms; changes in the mechanisms for dealing with challenges; critical capacity to choose the best option based on

	working; change in strategies to face challenges		evidence and outcomes.

This chapter has established the methodological bases for the analysis presented in this dissertation. First, the chapter establishes a social-ecological systems approach that reflects the complexity to which resilience refers. It adopts/adapts and operationalizes the Safe and Just Space because this model simultaneously addresses hum and environmental needs in development processes.

The chapter also presents the purpose of these main concepts utilized in this dissertation as well as their relationship to each other. The Safe and Just Space represents a normative objective. It acts as the reference for policy analysis and the ideal type against which empirical study is conducted. Normative coherence for the safe and just space is the conceptual and methodological approach through which analysis can illustrate whether policies are aligned with the safe and just space or not. By examining development plans before and after a crisis, this approach can highlight whether policy learning has occurred through a comparative examination of alignment levels. Finally, antifragility is discussed to analyze responses of policy networks during crises. This also potentially explains why learning occurs, should this be the case. In an ideal scenario, antifragility governance would occur throughout policy networks during a crisis (T1), and this would provoke policy

learning resulting in more normatively coherent for the safe just space policy frameworks in T2. The following empirical chapters implement this approach and present empirical findings to be compared to this scenario.

Chapter 5. Normative Coherence for a Safe and Just Space: Empirical Analysis

The previous chapters have presented conceptual debates on environmental threats and the need for resilience. These discussions are widespread at the global level where exchanges on resilience have been characterized by a sense of urgency. For example, the 2022 15th Conference of the Parties (COP15) to the United Nations Convention on Biological Diversity (CBD) produced a landmark agreement for the protection of the world's biodiversity. The outcome, known as the "30 x 30" Conservation Plan would place 30 percent of global land and sea under governmental protections which reinforces the acknowledgment of humanity's need to address the loss of biodiversity.

However, national policy responses have not adequately reflected the spirit or content of these discussions. While global agreements, including the SDGs, recognize the complexity of social-environmental threats, policy implementation of sustainability and resilience goals at the national level reflects narrowed policy approaches that impede sustainability mainstreaming by reinforcing sector-specific programs. Koff (2016) has illustrated how national conceptualizations of security have converged around narrow security definitions even though international approaches have broadened to encompass both human and environmental security issues.

These discussions are not simply abstract. This dissertation proposes normative coherence for a safe and just space as an analytical lens through which

to empirically study public policy and how it addresses vulnerability. Better said, it studies policy frameworks and questions how coherent they are with the safe and just space proposed by Raworth's Doughnut Economics. Specifically, the chapter presents the empirical analysis of the State of Veracruz's Development Plans in order to operationalize normative coherence for the safe and just space as a method for understanding how whether policy approaches contribute to or undermine resilience in specific territories. This research is based on content analysis of the Development Plans. Public policies that frame coffee (or agriculture in general) in relation only to "production", such as development plans or agriculture sectoral plans, also contribute to vulnerability because they do not account for the policy interactions that will be presented later on when the coffee rust shock is described.

As stated in previous chapters, this dissertation builds on Policy Coherence for Sustainable Development (PCSD) approaches to address systemic issues such as coffee rust and coherence for the safe and just space. There is an ongoing discussion of the different ways in which PCSD addresses sustainability issues and assists policy design and implementation. Several authors have advocated for approaches such as problem-oriented perspectives in PCSD (Kirsop-Taylor & Hejnowicz, 2022), participatory policy design (Kirschke & Kosow, 2022), complex thinking in sustainability strategies, and the integration of policy impact networks within and between policy mixes (Kosow et al., 2022), analysis of policy instruments and institutional performance (Huttunen, 2015; Wiedemann & Ingold, 2022) and the intersection of sectoral policies and stakeholders practices (Huttunen, 2015).

This rich collective literature on the implementation of policy coherence for sustainable development provides an excellent platform for discussions of a safe

and just space because it identifies problems with existing sustainability governance mechanisms. For example, Koff (2021) highlights the shortcomings of environmental impact assessment (EIA) in Mexico through a PCD analysis of EIA procedures. He explains that inappropriate guidelines undermine sustainability by designing/reinforcing a system in which environmental conservation is necessarily pitted against economic development in local communities. This also undermines social cohesion because it reinforces cleavages between different policy communities.

This distinction exists throughout the policy literature on sustainable development. Michael Redclift (2005) famously wrote that sustainable development is "an oxymoron coming of age." He contended that environmental concerns cannot be addressed without recognizing their pairing with social needs. The safe and just state embraces this approach. As stated above, Raworth's doughnut model juxtaposes the attainment of social equity with respect for environmental boundaries. The presentation of the doughnut above also indicates the difficulties that have arisen with the implementation of this model. This is the focus of this chapter.

Grounding the Doughnut through local implementation

Sustainable Development has emerged as a global norm. However, implementation rests with national and sub-national policy actors which explains the significant variance in the implementation of the 2030 Sustainable Development Agenda in different parts of the world (see Lizama-Pérez, et. al., 2018; Ignacio González, Santos and London, 2021). The most prominent example of this is Local Agenda 21 which emerged from the Rio + 20 Earth Summit in 1992, establishing a

role for sub-national authorities in sustainable development policymaking (Turner and Wills, 2022).

Doughnut Economics has similarly been proposed as a global model for sustainable development. However, like more institutionalized approaches resulting from United Nations summits, implementation for the safe and just space generally falls to national and sub-national authorities. Downscaling this approach to sustainability has been fraught with certain challenges. Turner and Wills (2022) have identified important difficulties with this exercise. According to these authors, the first difficulty is that research related to downscaling the doughnut has primarily focused on interpreting and measuring key parameters across scales. This is undermined by the fact that environmental ceilings are hard to define at the sub-national level because they can be considered context-specific. Moreover, the lack of sub-national data related to environmental ceilings poses a significant challenge for these models. Similarly, social foundations are often tied to cultural contexts which raise the debate on universal measures vs. local interpretations. These issues characterize the coffee systems addressed in this dissertation. Because these systems are characterized by unequal distribution of benefits in transnational value chains, social viability Is not only linked to production issues. At the same time, environmental questions are hard to measure locally due to the embeddedness of coffee in “living systems” as mentioned above.

Turner and Wills (2022) identify three specific issues with doughnut implementation at the sub-national level that are related to these difficulties:

1) Representing, understanding, and responding to complex systems: this task requires goal setting to be informed by an understanding of context-specific

social and ecological trends and how they interact to influence both local and planetary outcomes. Here the authors emphasize the need to establish communication between policy scales.

2) Goal coherence across scales: the authors recognize the presence of a plurality of stakeholders in local sustainability debates and the need to establish goal coherence.
3) Navigating power dynamics, inequalities, and trade-offs: here the authors recognize the complexities of policymaking as specific policy choices can have intended and unintended consequences for other policy arenas.

These issues have been addressed in different models through attempts to redefine public policy. For example, Mouysset et. al. (2018) propose a model in which policy sectors or dimensions are re-defined as “safe policy spaces” which contribute to a formal methodology called “Co-Viability Analysis (CVA).” The authors contend that safe policy spaces should not be prescriptive, nor should all policy boundaries be defined through universal units of measurement. As such, this policy approach aims to incorporate flexibility in decision-making as a means to surpass the existence of policy silos.

The city of Amsterdam has actually designed an urban development strategy around Raworth’s model called *The Amsterdam City Doughnut* (Doughnut Economics Action Lab et al., 2020). This strategy is based on the model presented in figure 5 below. Moreover, the city sets out concrete policy principles which represent ideals for the implementation of the doughnut. These principles are presented in Figures 6 and 7 which detail policy objectives at the local and global levels related to social equity (figure 6) and environmental boundaries (figure 7).

Figure 5. Doughnut model in Amsterdam. Source: *The Amsterdam City Doughnut*. Amsterdam: City of Amsterdam.

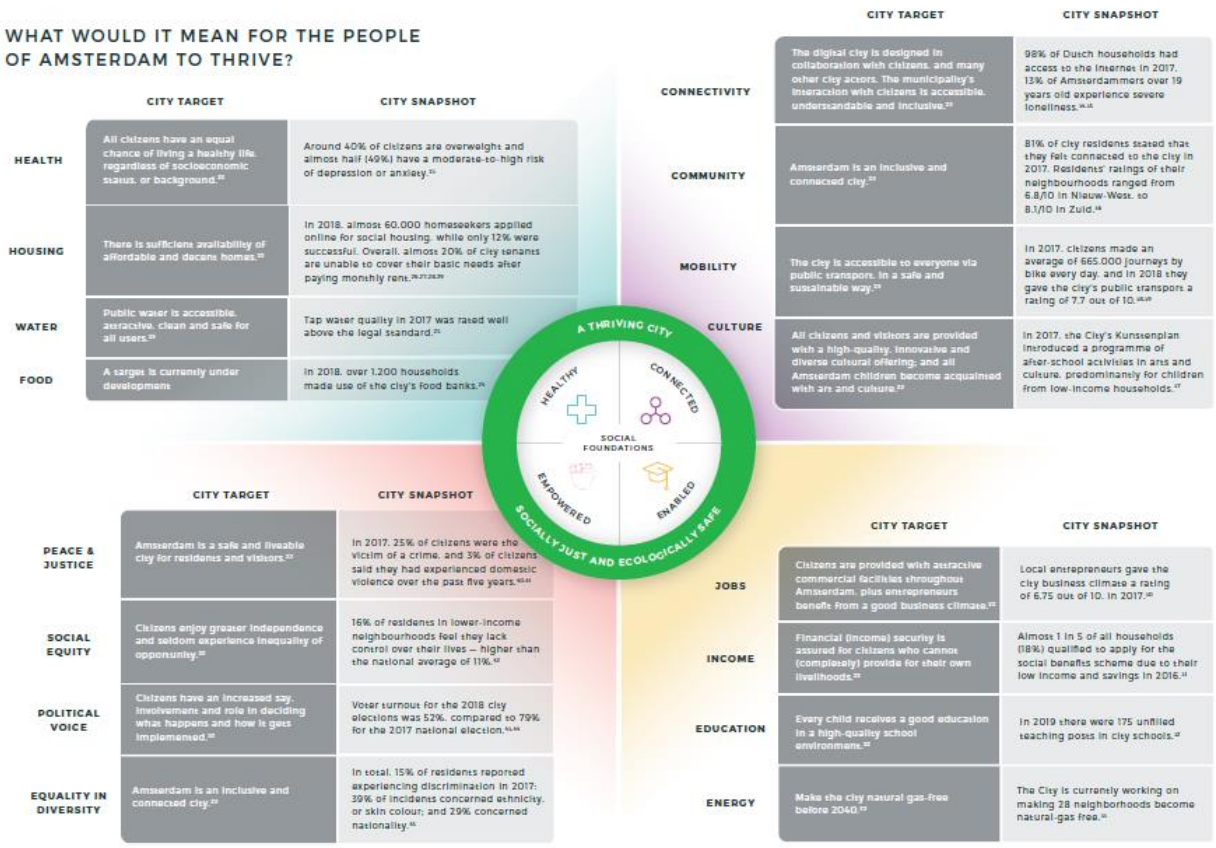


Figure 6. Snapshot of Amsterdam's doughnut. Source: The Amsterdam City Doughnut. Amsterdam: City of Amsterdam.

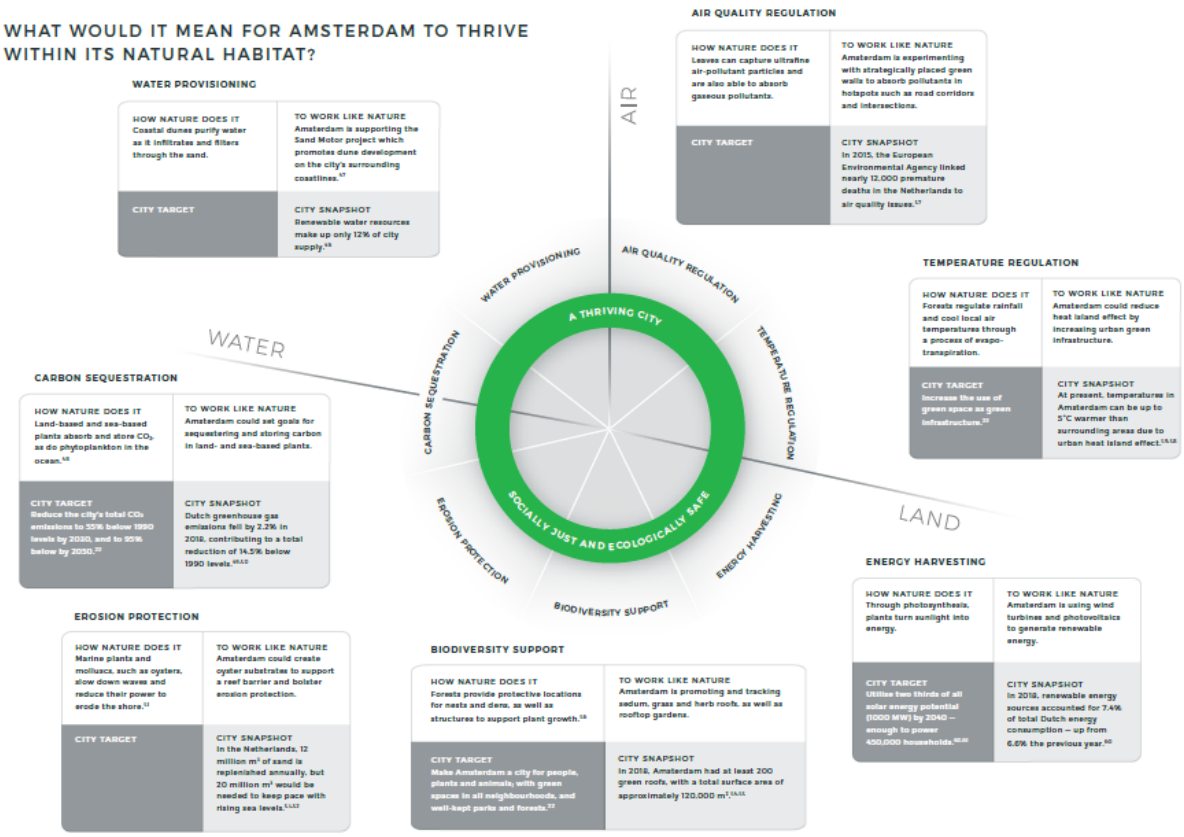


Figure 7. Amsterdam thriving in the natural habitat model. Source: The Amsterdam City Doughnut. Amsterdam: City of Amsterdam.

These models are innovative because they define policy objectives that respect the boundaries of the safe and just space. They establish clear and attainable guidelines that aim to reinforce the city's commitment to a circular economy, reinforcing both sustainability and resilience. What is most impressive is that the city plan also includes consideration of Amsterdam's place in global networks, and it establishes goals related to social equity and planetary boundaries that are related to Amsterdam's place in the world. This is a model of policy innovation for the promotion of sustainable cities worldwide.

Having recognized the value of these approaches to Doughnut implementation, some considerations need to be raised despite the great value that these approaches inherently demonstrate. First, the establishment of “safe policy spaces” as described above does incorporate necessary flexibility in policymaking. However, this flexibility could act as a double edge sword. As policy boundaries can have different units of measurement, then this could fragment sustainability norms which should guide policymaking at the local level. Turner and Wills (2022) recognize this in their article where they specifically identify a lack of strong normative guidance as a vacuum that needs to be addressed in local approaches to the safe and just space. Second, Amsterdam’s approach, impressive as it may be, seems to be static. It establishes concrete commitments to social equity and respect for planetary boundaries at different scales. However, it does not necessarily address power imbalances, nor does it mention the existence of tradeoffs. Without placing tradeoffs at the center of the policy model, the city’s approach seems to simply redefine policy silos (equity vs. planetary boundaries) rather than introduce measures to eliminate them. These issues are addressed in the section below.

Normative Coherence for a Safe and Just Space in Practice

Raworth’s doughnut represents an important model for re-conceptualizing sustainable development. As such, it should be employed as a model for policy analysis. This research partially implements the analytical approach proposed by the research team associated with the GAMMA-UL Chair in Regional Integration and Sustainability (Koff, Challenger, et al., 2020). This approach presents a methodology based on four steps: 1) Normative modeling of “Sustainable Development” to be

pursued, 2) recognition of keywords in policy documents that signal either reinforcement or undermining of these normative definitions, 3) modeling of policy analysis based on 8 typologies of policy (in)coherences and 4) application of these typologies to the analysis of policy implementation. Because this dissertation has adopted an antifragility framework to address responsiveness to crises, steps three and four focusing on implementation have not been adopted here. They will be addressed through antifragility in chapter six. Instead, this chapter focuses squarely on the normative coherence of policies. It engages specifically with the policy definition.

As stated above, normative coherence for sustainable development addresses the normative commitments made through policies, strategies, programs, projects, etc. to key sustainability principles. This study has adopted the safe and just space as a normative objective that should guide policy definition.

Chapter four above has introduced table 6 showing scales of normative (in)coherence. This type of scaling was originally introduced by Nilsson et. al. (Nilsson et al., 2018) to map interactions between sustainable development goals. Similarly to the research conducted through the GAMMA-UL Chair, I propose concepts such as sustainable development, resilience, and the safe and just space as norms and it utilizes scaling to measure the distance between policies and those norms. Stated another way, this approach does not study the coherence of one policy to another. Instead, it examines the coherence of each policy to a common normative vision. The more policies that are coherent for this paradigm (i.e. sustainable development, resilience, etc.), the stronger normative coherence is. The

smaller number of policies that are coherent for an ideal, the weaker the amount of normative coherence.

For this reason, this dissertation utilizes the safe and justice space as a normative compass. It does not measure the distance between social and environmental policy as simple tradeoffs. Instead, proposes normative coherence for the safe and just space as a barometer for the distance between policies and respect for both social equity and environmental boundaries and introduces protection as another dimension of the safe and just space. As such, it does not attempt to define the boundaries of the safe and just space only empirically, but it examines its dynamics and ways in which policies contribute to it.

This study adopts the approach developed by Koff et al. (2022) in which the authors proposed a methodology for the analysis of sustainable development norms in Mexico's legal framework. It investigated whether laws have integral or partially integral relationships with each dimension of sustainability, whether they directly or indirectly affect sustainability, and whether the commitment to sustainability is intentional or unintentional. NCSD is viewed as relationships that reinforce legal commitments to an individual dimension of sustainability, whereas normative incoherences for sustainable development examine relationships that undermine such commitments. The magnitude of coherence/incoherence (depending on the reinforcing or undermining relationship) is conceptualized as a series of steps: first focusing on integrality, then incorporating directness, and finally addressing intention.

This dissertation employs the same logic. It questions whether policies are 1) coherent or incoherent with social equity, 2) coherent or incoherent with respect for

planetary boundaries, and 3) coherent or incoherent with the new dimension of the doughnut proposed here and defined as generalized protection against shocks. This approach addresses the three concerns proposed by Turner and Wills (2022): 1) the implementation of systems thinking, 2) policy coherence in the definition of objectives, and 3) consideration for inequalities and tradeoffs. By employing the scaling explained in the previous chapter, this research can explain how policies relate to equity and environmental policy and more importantly, it illustrates how these policies relate to the safe and just space as a normative compass. The scales also introduce nuanced analysis as they aim to indicate levels of coherence with social equity, protection of environmental boundaries, and protection against shocks. There is a strong difference between a policy that is directly and completely coherent from a normative standpoint with a key principle of the safe and just space and a policy that only creates general conditions in which the safe and just space can evolve. Also, the application of the "glaze" to the doughnut which inserts consideration of generalized protection from shocks introduces an element of analysis that is highly relevant to discussions of resilience. I analyze two State Development Plans for Veracruz, Mexico.

The dimensions and normative categories of the "glazed" safe and just space ("glaze" refers to protection) elements of the analysis are presented in table 9 which introduces the qualitative characteristics of each of the dimensions for specific policy arenas. These characteristics can be considered ideal types of coherent policies.

Table 9. Characteristics of the safe and just space in the empirical analysis of the Veracruz State Development Plans. Source: Table made by the author based on Koff, Challenger, and Portillo, 2020.

Policy arena	Social equity	Planetary boundaries	Protection
Governance	Establishment of citizen decision-making systems and universal service provision mechanisms	Inclusion of environmentalist advocates in decision-making processes and norms against natural resources misuse/overexploitation horizontal decision-making;	Responsive governance policies and anticorruption mechanisms and systems enabled and implemented; anticorruption, responsiveness, and preventiveness
Infrastructure	Investment in infrastructure basic for universal service provision	Investment in green infrastructure for service provision, environmentally friendly/responsible infrastructure, and nature-based solutions	Transparent urban planning; mobility and communication equal access
Economic	Economic integration programs, human capital creation, job training,	Regenerative economic design and circular and green economy	Protection against deregulated/liberalized markets; economic protections

	unemployment insurance, etc.; social security measures;		aimed at stabilizing standard of living and transparent regulation of economic markets/ taxation; transparency regulation standardization of well-being.
Social	Social integration, Anti-discrimination, Inclusion, and respect of indigenous and other ethnic minorities (such as afromexicans)	sustainable development, development models compatible with sustainable development	Universal social welfare and social security
Environmental	Equal access to strategic natural resources/ ecosystem services	protection and conservation of population and species of fauna and flora, climate change fight, and conservation of earth's vital process	Sustainable environmental conservation; transparency on the use of natural resources

Security	Security for all	Risk mitigation and vulnerability reduction; nature-based solutions	protection from violence and hazards; Rights-based security framework;

As stated above, this analysis was applied to the State of Veracruz's Development Plans for the periods 2011-2016 and 2019-2024. These plans were chosen for two reasons: 1) they are the state policy frameworks that guide all the sectorial policies, constituting a wide and representative policy instrument for the state; the 82 municipalities in the coffee-producing region of Veracruz rely mostly on the state-level policies in terms of coffee related policies; 2) the State Development Plans for these two periods were chosen since they cover the time periods of alignment (before the coffee rust major outbreak -2011-2012-) and realignment (2018 was the year in which the phytosanitary authorities reported a steep decrease on the coffee rust prevalence in Veracruz's state). By comparing the results of normative coherence of the State Development Plans, we can examine whether any policy learning occurred from the shock: coffee rust major outbreak in Veracruz. The period of de-alignment, in which the shock happened is addressed in the next chapter which focuses on antifragility and shock responsiveness.

The results presented below provide scores for each of the dimensions of the glazed doughnut, but they also provide overall scores for both the doughnut and the glazed doughnut which represent the empirical representation of normative (in)coherence for a safe and just space. The research examined all objectives,

strategies, and lines of action within these sustainable development sectors. This included 183 objectives, 547 strategies, and 673 lines of action defined in the 2011-2016 State Development Plan. It studied 16 objectives, 16 strategies, and 91 lines of action defined in the 2019-2024 State Development Plan. As mentioned in chapter four, an objective is the declaration of a specific policy goal within a sector. A strategy integrates means of implementation for the associated objective. The lines of action define concrete implementation mechanisms including specific projects. This research analyzed each objective, strategy, and line of action for each policy arena of the plans (Governance and political life, Infrastructure, Social development, Economy, Environment, Security) in relation to a specific characteristic of the safe and just space (equity, planetary boundaries, and protection). When the objective, strategy, or line of action undermined a characteristic of the safe and just space, a negative value was assigned based on the criteria presented in table 9. When the objective or strategy reinforced a characteristic of the safe and just space, a positive value was assigned according to these same corresponding criteria. For example, table 10 provides two examples of scoring specific objectives of the 2011-2016 Development Plan. The first social objective in the table reinforces directly and completely the social equity category of the safe and just space since it makes substantive normative commitments with it because it reinforces social development by promoting co-responsible, fair, and solidary social participation and capacity building, which are key elements for an integrated and inclusive society. On the other hand, when it comes to the planetary boundaries, it indirectly undermines this category since it lacks the sustainability aspect of social development, it does not mention at all environment which can threaten the respect of planetary boundaries.

Finally, the social objective discussed above indirectly creates conditions that can potentially further social welfare and social security. Since human and social development are mentioned but not specifically as a means to enhance universal welfare and social security, the score isn't higher.

The aim of the second social objective in the example makes substantive commitments to social equity by addressing poverty and marginalization focusing specifically on the population with social gaps, which creates the conditions of an inclusive society. This objective indirectly undermines the respect of the planetary boundaries since it doesn't mention the environmental side of development, there's no recognition of the importance of preserving the earth's cycles that create the conditions for sustainable development. On the other hand, this objective directly and mutually reinforces protection by focusing on well-being and welfare poverty, and marginalization policies.

Table 10. Example of scoring of an objective. Source: made by the author based on Koff et al. 2020.

Policy arena	Objective	Social Equity	Planetary boundaries	Protection
social	Linking social development actions with human development actions, as well as fostering and build skills and capacities of the	+3	-1	+1

	Veracruz population, as a requisite for a co-responsible, fair, and solidary social participation.			
	Design and implement policies to combat poverty and and marginalization, through various social programs that as a whole, increase the levels of well-being of those who live in populations with high social gaps.	+3	-1	+3

Source: Table established by the author.

Coffee rust as a systemic issue

This dissertation addresses the problem of coffee rust in Veracruz, Mexico. Rust is not a new threat to coffee growers. It arrived in the Americas in 1970 (principally in Brazil) and slowly infected the entire continent. The first cases were reported in Mexico in 1983 (in Chiapas). Rust attacks the leaves of coffee plants which prevents the fruit from growing. From the leaves, it spreads to the branches and eventually

kills the plant. It is a very resistant plague because its spores can remain latent and reinfect plants numerous times (Servicio Nacional de Sanidad, 2016).

From 2012-2015 coffee rust became a major problem throughout the Americas, including Mexico. Even though there are reports on how coffee rust became a major issue since 2011, there is a consensus on the date of the biggest outbreak being during the harvest of 2012 (Hernández-Martínez & Velázquez-Premio, 2016; McCook & Vandermeer, 2015; Renard, 2022). El Salvador was the most affected country as 74% of the nation's coffee plants were infected by rust (Alvarado-Castillo, 2015; Avelino et al., 2015). Mexico saw 40% of its plants impacted. Despite it having previously been controlled through sanitary practices, the outbreak in Mexico lasted until 2018. However, the failure of the International Coffee Agreement in 1989 led to price instability (Portillo, 1983; GAMMA-UL chair interviews, 2019). Low profits, combined with increased costs related to materials, energy, and agricultural wages forced growers to invest less in the sanitation of coffee plants. Combined with the effects of climate change, this process led to generalized outbreaks of rust in coffee-growing communities. Moreover, crop insurance was and continues to be very expensive in Mexico and few farmers invest in it due to limited coverage and high prices (GAMMA-UL chair interviews, 2019).

Experts such as Alvarado-Castillo (2015) have highlighted the systemic impacts of coffee rust in coffee-producing communities such as Central Veracruz. The mass loss of coffee plants has had perduring economic, environmental, and social impacts. For example, the loss of coffee plants leaves soil exposed to the forces of erosion which undermines sustainable agriculture in general. This vulnerability contributes to loss of income and consequently, decreased employment

and heightened poverty in coffee-growing communities. Such conditions contribute to migration to cities because coffee no longer provides sustainable livelihoods. On top of this, coffee holds a cultural/symbolic significance in Central Veracruz around which auxiliary sectors, such as tourism have coalesced. These problems are even more complicated for specialty coffee producers. Interviews with growers who specialize in organic and biodynamic production explained how these producers were forced to choose between the use of pesticides to save their crops and the loss of certifications and internationally recognized quality control labels (personal interviews, 2019). Consequently, rust represents a systemic threat not only to coffee growers but to entire communities. It cannot simply be considered an “agricultural problem.”

Results

The empirical analysis conducted through the normative coherence for a safe and just space framework is presented in the six tables below. The first three tables 11, 12, and 13, present normative coherence for safe and just space (NCSJS) scores for the Veracruz State Development Plan from 2011-2016. The second three tables, 14, 15, and 16 include NCSJS scores for the Veracruz State Development Plan from 2019-2024. The number of objectives is not directly comparable with the number of strategies and lines of action because there are more of the latter than the former. Moreover, the dimensions of the plans cannot be directly compared because certain dimensions have more objectives, strategies, and lines of action than others. For this reason, this research establishes a comparative framework by presenting NCSJS coefficients. Each dimension score is divided by the maximum score possible for that dimension. For example, the Governance and political life dimension of the

2019-2024 Plan has 16 objectives. A maximum score for this dimension would be 48 (16 x 3). The real NCSJS score for this dimension is 38. Therefore, the coefficient present in the table is 0.79 which is 38 divided by 48. The closer a score is to one, the more coherent it is with a characteristic of the safe and just space.

Table 11. Normative coherence for the safe and just space scores for objectives of the 2011-2016 State Development Plan of Veracruz.

Component/policy arena	Normative coherence for social equity	Normative coherence for respecting planetary boundaries	Normative coherence for protection	Normative coherence for the safe and just space	Normative coherence for the glazed safe and just space
Governance and political life	0.91	0.05	0.88	0.48	0.61
Infrastructure	0.86	0.19	0.83	0.53	0.63
Economy	0.53	0.02	0.51	0.27	0.35
Social Development	0.69	0.15	0.61	0.42	0.48
Environment	0.95	0.94	0.97	0.95	0.95
Security	0.82	0.47	0.83	0.64	0.70
Sum	4.76	1.82	4.63	3.29	3.74
Mean	0.79	0.30	0.77	0.55	0.62

Table 12. Normative coherence for the safe and just space scores for strategies of the 2011-2016 State Development Plan of Veracruz.

Component/policy arena	Normative coherence for social equity	Normative coherence for respecting planetary boundaries	Normative coherence for protection	Normative coherence for the safe and just space	Normative coherence for the glazed safe and just space
Governance and political life	0.64	0.18	0.58	0.41	0.47
Infrastructure	0.73	0.30	0.70	0.51	0.58
Economy	0.49	0.07	0.46	0.28	0.34
Social development	0.71	0.18	0.71	0.45	0.53
Environment	0.94	0.95	0.94	0.94	0.94
Security	0.64	0.03	0.70	0.34	0.46
Sum	4.15	1.71	4.09	2.93	3.31
Mean	0.69	0.28	0.68	0.49	0.55

Table 13. Normative coherence for the safe and just space scores for lines of action of the 2011-2016 State Development Plan of Veracruz.

Component/policy arena	Normative coherence for social equity	Normative coherence for respecting planetary boundaries	Normative coherence for protection	Normative coherence for the safe and just space	Normative coherence for the glazed safe and just space
Governance and political life	0.56	0.32	0.59	0.44	0.49
Infrastructure	0.67	0.23	0.65	0.45	0.52
Social development	0.75	0.19	0.73	0.47	0.56
Economy	0.56	0.03	0.54	0.30	0.38
Environment	0.81	0.81	0.82	0.81	0.82
Security	0.53	0.10	0.65	0.31	0.43
Sum	3.89	1.68	3.99	2.79	3.19
Mean	0.65	0.28	0.66	0.46	0.53

Table 14. Normative coherence for the safe and just space scores for objectives of the 2019-2024 State Development Plan of Veracruz.

Component/policy arena	Normative coherence for social equity	Normative coherence for respecting planetary boundaries	Normative coherence for protection	Normative coherence for the safe and just space	Normative coherence for the glazed safe and just space
Governance and political life	0.44	0.22	0.67	0.33	0.44
Infrastructure	1.00	-0.33	0.67	0.33	0.44
Economy	1.00	0.42	0.75	0.71	0.72
Social	0.58	0.00	0.58	0.29	0.39
Environment	1.00	1.00	1.00	1.00	1.00
Security	1.00	0.11	1.00	0.56	0.70
Sum	5.03	1.42	4.67	3.22	3.70
Mean	0.84	0.24	0.78	0.54	0.62

Table 15. Normative coherence for the safe and just space scores for strategies of the 2019-2024 State Development Plan of Veracruz.

Component/policy arena	Normative coherence for social equity	Normative coherence for respecting planetary boundaries	Normative coherence for protection	Normative coherence for the safe and just space	Normative coherence for the glazed safe and just space
Governance and political life	0.44	-0.33	0.33	**0.06**	**0.15**
Infrastructure	1.00	-0.33	0.33	**0.33**	**0.33**
Economy	0.50	-0.25	0.42	**0.13**	**0.22**
Social	0.53	0.20	0.27	**0.37**	**0.33**
Environment	0.67	1.00	1.00	**0.83**	**0.89**
Security	0.83	0.17	0.83	**0.50**	**0.61**
Sum	3.98	0.45	3.18	2.21	2.54
Mean	0.66	0.08	0.53	0.37	0.42

Table 16. Normative coherence for the safe and just space scores for lines of action of the 2019-2024 Veracruz Development Plan.

Component/policy arena	Normative coherence for social equity	Normative coherence for respecting planetary boundaries	Normative coherence for protection	Normative coherence for the safe and just space	Normative coherence for the glazed safe and just space
Governance and political life	0.56	0.32	0.59	0.44	0.49
Infrastructure	0.67	0.23	0.65	0.45	0.52
Social development	0.75	0.19	0.73	0.47	0.56
Economy	0.56	0.03	0.54	0.30	0.38
Environment	0.81	0.81	0.82	0.81	0.82
Security	0.53	0.10	0.65	0.31	0.43
Sum	3.89	1.68	3.99	2.79	3.19
Mean	0.65	0.28	0.66	0.46	0.53

These coefficients indicate some important trends. First, previous research conducted by the GAMMA-UL Chair research team using this method clearly showed that resilience coefficients were consistently much higher for development plan objectives than they were for strategies and lines of action (Koff et. al., 2022). This confirmed a trend that is well-documented in the literature on public policy in Mexico which documents how policies are well-written but poorly implemented in part because strategies and lines of action are not appropriate for the successful achievement of policy goals (see Cejudo y Michel, 2016; Cetina Arenas et. al., 2022). This trend is not necessarily evident in this analysis. Instead, table 17 below shows how objectives do have the highest NCSJS coefficients. However, lines of action show higher normative coherence for a safe and just space and glazed safe and just space scores than strategies across the two plans. These scores are quite consistent between the plans as the objectives and lines of action scores remained the same. Only the strategy coherence scores fell from the 2011-2016 plan to the 2019-2024 plan. While these results can be interpreted in different ways, the fact that they contradict accepted policy beliefs in Mexico is interesting. Most important is the lack of evidence of improvement in the scores between the two plans. Because the objectives and lines of action scores remained the same and the strategy scores worsened, there is no sign of policy learning. Even the sectoral scores remained consistent within the plans. The rust shock does not seem to have led to any significant policy improvement for the establishment of the safe and just space in any of the policy sectors in relation to any of the characteristics of the safe and just space (social equity, respect for planetary boundaries, protection).

Table 17. Comparison of NCSJS Coefficients by Objectives, Strategies, and Lines of Action in 2019-2024 State Development Plan of Veracruz.

	Normative coherence for the safe and just space	**Normative coherence for the glazed safe and just space**
Mean Objective Scores Across the two plans	0.55	0.62
Mean Strategy Scores Across the two plans	0.43	0.48
Mean Line of Action Scores Across the two plans	0.46	0.53

Source: Table established by the author based on data presented in tables 12 to 16.

A third clear trend illustrated by tables 12, 13, 14, 15, and 16 shows that the socio-economic dimensions of the safe and just space are privileged over planetary

boundaries. Table 18 highlights the consistency of high coefficients for social equity and protection against shocks compared to very low scores for respect for planetary boundaries. This confirms findings from previous research on normative coherence for sustainable development in Mexico. Koff et. al. (2022), showed how the social dimension of sustainable development is privileged at the national level at the expense of environmental sustainability. This was reinforced by the findings of a 2020 study commissioned by the Mexican Congress. In this evaluation of 128 of Mexico's federal laws, conducted by a team comprising both academic experts and federal legislators, to find “areas of opportunity” to improve the coherence of legislation for the express purpose of implementing the SDGs, the conclusions stated that the environmental dimension of sustainability was “scarcely present” in national legislation (Cámara de Diputados, 2020). Koff et. al.’s (2022) analysis of the Veracruz legislative framework confirmed this finding as normative coherence for the social dimension of sustainability was almost twice the score achieved for the environmental dimension.

Table 18. Comparison of NCSJS Coefficients in 2011-2016 and 2019-2024 Veracruz State Development Plans by Characteristic of the Safe and Just Space.

	Social Equity	Planetary Boundaries	Shock Protection

Veracruz State Development Plan 2011-2016	0.71	0.28	0.70
Veracruz State Development Plan 2019-2024	0.72	0.2	0.66

Source: table established by the author based on data from tables 12 to 16.

One potentially paradoxical point to raise from the results presented above concerns the normative coherence for a glazed safe and just space. The addition of the "glaze" to the doughnut model intends to link Raworth's model more closely to resilience, moving it away from representing a general portrait of "sustainability." The purpose of this column is to examine whether the Veracruz State Development Plans protect communities from external economic and environmental shocks. As stated above, the scores for this column were generally high (mean of 0.68 for the two plans) showing that State authorities were not only interested in promoting economic growth and exposing local communities to shocks but that attention was paid to the need for protection. Consequently, the "glazed" scores for the safe and just space are higher than the "unglazed" scores for both State Development Plans. This seems to contradict the economic policy-making literature in Mexico (see Gerber, 2020)

which focuses squarely on the country's commitments to free trade agreements, especially the US-Mexico-Canada Free Trade Agreement (formerly the North American Free Trade Agreement). This literature examines how the country has subverted shock protection to increase national wealth through free trade (see Vázquez Gálvez and Rivera-Lozano, 2018).

The paradoxical point here relates to the sectoral scores for the objectives, strategies, and lines of action in the State Development Plan. While the overall scores for shock protection were high, the lowest NCSJS coefficients for almost all objectives, strategies, and lines of action in both plans were found in the "Economy" section of the plan. Only the objectives of the Economy section of the 2019-2024 Development Plan received a high NCSJS coefficient (glazed and unglazed). All of the other scores related to economic development were the lowest in their respective table. This seems to indicate that protection against shocks has been mainstreamed well in the State Development Plans but that this important new characteristic of the glazed doughnut has not been integrated into economic planning. This would indicate that economic policies in Veracruz undermine resilience and protection against shocks, even though the overall attention to protection is high throughout the plan.

Similarly, the situation related to environmental resilience seems paradoxical. As stated above, the scores for respect for planetary boundaries are by far the lowest for the different characteristics of the glazed doughnut analysis. At the same time, the highest NCSJS scores found in each tables 12, 13, 14, 15, and 16 presented above are for the Environmental objectives, strategies, and lines of action. Contrary to the scores for the economy, this trend indicates that environmental policies are

well written to include all three characteristics of the doughnut (social equity, protection for planetary boundaries, protection against shocks) but environmental considerations are not mainstreamed in the other dimensions of the State Development Plans. Consequently, the protection of planetary boundaries remains sector-specific which reinforces policy silos in relation to environmental issues. This undermines normative coherence for a safe and just space.

Discussion

The aforementioned results show significant relevance to the situation of coffee-producing communities in Central Veracruz. In general, these communities are characterized by geographic isolation, and social marginalization, and the growers are challenged by a lack of viability in the coffee market. In 2019 (Gamma UL Chair, interviews) and 2021 interviews with public officials about coffee production in the area, four of the five local and state officials interviewed identified international price fluctuations as the greatest threat to sustainability in the geographic region. In addition, consultants and executives working for two of the biggest coffee traders in the world (Greyfus and Neumman) and one agro-industrial coffee producer signaled that this is especially the case for small coffee growers, which are most exposed to these threats. Of the five public officials, three more discussed at length the migration, especially of youth, away from coffee-producing territories due to the lack of economic viability. This was also mentioned by all the coffee growers. All the coffee growers' interviews indicated that the cost of production (USD 1.20 per kilo) was higher than the profit from the sale of coffee at that time (USD 1.10), pointing

out as well that the government subsidies for the coffee sector constitute less than 20% of the production costs.

As stated above, this situation seems to be related to the normative incoherences in development policies in Veracruz. While the overall plan seems to be normatively committed to a safe and just space, the economic sector lags significantly. Moreover, the fact that other policy sectors are committed to the safe and just space when economic planning is not, reinforced policy silos. This hinders the establishment of the safe and just space as a mainstreamed norm for resilience in coffee-producing communities. Without mainstreaming, the safe and just space cannot be implemented. The city of Amsterdam's approach provides an interesting blueprint for this.

In Mexico, instead, agricultural policymaking is viewed at different levels as an issue of production and commercialization. For example, the National Agricultural Plan (NAP) does note that "Development depends on funding for access to quality education, the generation of income, support for the creation of employment and mechanisms for sufficient social protection." (SAGARPA 2017a, p. 18). In addition to poverty reduction and social inclusion, the NAP also addresses climate change, disaster prevention, security, conflict prevention, competition for natural resources, and science and technology innovation. Similarly, the plan asserts that one-third of all food produced in Mexico is wasted at some point in the supply chain, mostly during the harvest or post-production stage due to insufficient infrastructure," thus calling for more effective public investment (SAGARPA 2017a, p. 18).

The problem with the NAP is its emphasis on "productivity, profitability, and competitiveness to combat poverty and promote a more balanced regional

development” (SAGARPA 2017a, p. 7) in the country. While there is a need to give attention to productivity, profitability, and competitiveness, the state needs to assume a fundamental role in establishing formal commitments to markets regulation and policies that can serve as a buffer to producers, so they can be better prepared and protected from the volatility of the markets. The sector-specific strategy for coffee within the agriculture secretariat focuses on the expansion of consumption markets for Mexican coffee both nationally and abroad as well as the improvement of technical efficiency of production processes. This is normatively incoherent with the establishment of a safe and just space for local communities because it does not reinforce normative commitments to resilience through concrete actions. Increased economic production does not translate into sustainable social equity because it privileges large growers over smaller ones (often forcing small growers into informal markets where they earn considerably less per kilo). It undermines the protection of planetary boundaries because it promotes the expansion of monocultures which reduce biodiversity and erode land quality. Finally, such policies expose local communities to shocks when they focus on export through mediators at the expense of the reinforcement of local markets where value chains can be controlled by communities.

Similar policies have been developed by the State of Veracruz. Following the logic of national policies, Veracruz's agricultural policies have focused mainly on solving the problems of production, competitiveness, and agricultural yield. The State Agricultural plans, emphasize the importance of productivity, profitability, and competitiveness as a means to foster social development and poverty reduction in rural areas. From 2019 to 2024, similar to what the federal government has done,

agricultural policies have been focused on food security: “Feeding Veracruz” is the sectoral policy. This plan mentions sustainable production to contribute to food security as one of its objectives. Despite the importance of the coffee sector in Veracruz, the only mention of the coffee sector is found in one line of action: “to foster the production of strategic crops such as coffee, vanilla, pepper, and oil palm, amongst others”. The most prominent coffee policies are the ones corresponding to the implementation of the national policies on plague control and finances, capacity building of coffee growers, and support with agricultural supplies, which are focused on production and competitiveness as well as expanding the national consumption markets of coffee.

On the other hand, the law for the promotion, sustainable development, production, distribution, and commercialization of Veracruz’s coffee published in 2018 was created to be the framing policy of the coffee sector of Veracruz. This came as a response to the coffee rust and prices crises, and a long process of advocacy of policy entrepreneurs, which argue that its implementation hasn’t responded to the coffee growers' needs, as will be described in chapter 6.

The state law of coffee in Veracruz, similar to the sectoral coffee and agricultural policies of the federal government, also focuses on productivity and giving a key role in the coffee consumption markets promotion at the state, national and international level. It views the differentiated coffee markets as social development fostering mechanisms for coffee producers in the state. It enforces the budget allocation for financial support to coffee growers of different scales, focusing more on small coffee growers by making the Ministry of Economic and Port development responsible for funding coffee commercialization. Unlike the

agricultural and sectorial federal policies, this law includes in its goal, the efficacy of the stakeholders in all the agro alimentary chain of coffee under a sustainability and distributive justice perspective. This law is much more comprehensive than the federal policies as it includes the conformation of a consultive board on coffee and the creation of the institute of Veracruz's coffee growing (Instituto de la Cafeticultura Veracruzana in Spanish), therefore aiming to institutionalize participation in the different stakeholders in the coffee value chain and some of the relevant policy sectors such as trade, environment, and agriculture. It also recognizes the value of shade coffee plantations as ecosystem services providers, promoting their protection and sustainability. Contrasting with this, promotes the cultivation of different coffee varieties, including varieties that constitute monocultures without any shadow, which should be established if they are adapted and adequate to the local environmental scenarios.

Interestingly, private-public association and the agro-industrial sector collaboration with small-scale coffee producers is also a strategy mentioned in the law to trigger economic development and increase the competitiveness of Veracruz's coffee. It is worth saying that by mentioning it, the law highlights the importance of monitoring the coffee sector policies implementation to ensure that they are adequate to respond to the needs and challenges in the sector.

This particular law seems to be partially coherent with the safe and just space model I propose in this dissertation since it includes principles that are well-aligned with most of the categories I proposed. One of its strengths is that it promotes social participation and inclusion inside the coffee sector of the state, institutionalizing it through formal and recognized structures, such as the consultive council and the

coffee-producing institute of Veracruz. The protection of shadow coffee plantations, as key ecosystem service providers and the mention of sustainability in the sector, shows an interest to respect earth's vital cycles, therefore the protection of the planetary boundaries. The lack of a precise mechanism related to the minimum price as a mechanism of social justice hinders coherence with the glazed safe and just space because it doesn't protect the coffee growers from global market volatility and its effects on national markets. Despite the repeated mention of social development as a main goal of the law, not including the Social Development Ministry as a collaborating institution to design adequate policies that reduce the social systemic causes of inequalities in the coffee sector of Veracruz, diminishes the level of commitment of the law to the glazed safe and just space. On the other hand, the state of Veracruz, inside the office of the Government Program has instituted a council of the 2030 Agenda of Sustainable Development. This council has been created as an "instance of coordination between the agencies and entities of the public Administration in the state, whose purpose is to coordinate, design, implement, follow up, evaluate strategies, programs, actions, and public policies that ensure compliance with the 2030 Agenda" (Consejo Veracruzano de la 2030 Agenda). The 2030 Agenda of Veracruz is a pathway to pursue 9 of the 17 SDGs. Whereas it looks at the implementation of these goals, it does not look at the implementation of the linkages or the interlinkages between them. This adds up to the before-mentioned evidence of policy silos in the state of Veracruz.

This analysis indicates that the safe and just space presented by Raworth's doughnut cannot be viewed as an aggregate of parts that relate to each other. Instead, a safe and just space is a norm that must be mainstreamed through

commitments in all policy sectors. One limitation of this analysis was the need to focus on state development policy due to a lack of time. It would have been beneficial to study the linkages between the federal, the state, and the local but due to the time constraints imposed by the university for doctoral studies, this was not possible. Mainstreaming implies that one sector can undermine the normative coherence of a system. If one sector, such as the economy, does not commit to the safe and just space as a norm, then it is irreparably undermined. Sheehy and Feaver (2015) argue that all regulatory systems have a normative dimension which includes commitments to key values and a positive dimension that represents policy choices. They correctly argue that any choice related to sustainability (or resilience in this case) will be undermined if commitments are not made in the underlying normative dimension. This is how policymaking relates to the social construction of risk and vulnerability. Most analyses addressing the implementation of the safe and just space at the sub-national level focus directly on the positive dimension. They examine policy choices and attempt to reconcile tradeoffs. Instead, normative coherence is the key to successful implementation. Because we have not yet achieved this commitment at the sub-national level (see Turner and Wills, 2022), we have not yet been able to construct a positive dimension that can download the Doughnut Economics model. This is also the focus of the following chapter which examines direct responses to the rust shock in Central Veracruz.

Chapter 6. Antifragility as a response to crises in the safe and just space: an empirical analysis

Chapter five presented the first results of this dissertation, engaging with normative coherence for a safe and just space and how it enriches the discussions about implementing sustainability and addressing environmental threats. The sense of urgency mentioned in the previous chapter has been central in global discussions about crisis response and the need for resilience. Agency of stakeholders, from the global to the local, accompanies this need for urgency. The 2022 27th COP of the United Nations Convention on Climate Change, concluded with a New “Loss and Damage” Fund for Vulnerable Countries. This agreement comes with the reaffirmation of the signing countries to limit global temperature rise to 1.5 degrees Celsius above pre-industrial levels, as well as implementing actions to adapt to the inevitable impacts of climate change and boosting the support of finance, technology and capacity building needed by developing countries (United Nations Climate Press Release, 2022). Leaders of vulnerable countries have made clear the need for support for mitigation and adaptation to climate change. For example, the Assistant Secretary-General of the Organization of African, Caribbean and Pacific States (OACPS), Ms. Cristelle Pratt, shared the OACPS's disappointment with the international financial flows being 5 to 10 times lower than estimated needs, widening this gap and asking for timely access to sustainable climate finance as a key priority (United Nations Climate Press Release, 2022). Leaders of vulnerable countries, which have been the most affected by climate change, have made a

strong statement: they call for political action translated into financing, because they have the agency and the right to be compensated and act in their country's best interest, and in the best interest for their future generations and the world.

While this call has resonated globally and acknowledges the need for justice and compensation, the way to proceed and accomplish this has yet to be defined. Scholars have been studying how governance structures can hinder or promote mitigation and adaptation actions, as responses to environmental threats (Florini & Pauli, 2018; Newig et al., 2018). The design of the strategies in which the climate funds will be allocated must have as one of its considerations, governance across multiple scales in the recipient countries. In academia, there is a long-standing recognition of the key role of local governance in enacting change for sustainable development due to the proximity to communities and the ability to respond to context-specific issues (Reddy, 2016; R. A. Turner & Wills, 2022). While global agreements are translated into national programs and policies, their ability to make change depends not only on the frameworks implemented but also on effective governance to support their implementation.

Resilience and antifragility: responses to current crises

When we talk about frameworks and ways to respond to crises such as the climate change effects, a wide variety of governance proposals can be found. In terms of disaster risk reduction, the Hyogo Framework for Action (HFA): Building resilience of Nations and Communities is the internationally agreed framework to guide actions of disaster risk reduction. Resilience is the ability to resist, absorb and recover from hazards (Djalante, 2012). Authors such as Cavanagh criticize how contemporary approaches of social-ecological resilience don't satisfactorily account

for how processes of class formation and fragmentation under contemporary forms of capitalism effectively produce inequalities of exposure and vulnerability to environmental change processes (Cavanagh, 2017). Approaches that aim for a deep change in the damaging interactions haven't been sufficiently discussed in the resilience field. This dissertation considers resilience as a good starting point to improve conditions and responses to shocks but also recognizes that resilience can potentially mislead the understanding of the process in which SES can change to improve its functioning and overlook shocks as events that can lead to positive changes. Therefore, alternative approaches, varying from resilience have emerged. One of these variants is antifragility, which explains how shocks can reinforce the capabilities of social-ecological systems in the sense of transforming them so future negative effects of shocks are reduced. The choice of using antifragility derives from constructive criticism of resilience: systems experimenting shocks must change since the configuration and structures before the shocks did not enable them to cope with the shock and were contributing to their fragility. In this regard, antifragility is viewed as an improved feature in systems performance after resilience (Johnson & Gheorghe, 2013; Blečić & Cecchini, 2019; de Bruijn et al., 2020).

In this chapter, I apply the antifragility framework to the case of coffee rust in Veracruz. I first present the aspects of the case that are analyzed here stressing the governance challenges. The following section serves as a brief reminder of how antifragility has been defined and implemented so far and how I depart and add to this approach before we move on to the results.

Governance challenges in the case of coffee rust, Veracruz

This discussion is not merely theoretical. This dissertation addresses the problem of coffee rust in Veracruz, Mexico. As mentioned in the previous chapter, coffee rust in coffee-producing communities had systemic impacts. The loss of the main source of income and livelihood, unemployment, and increased poverty led to rural-to-urban migration flows from coffee-producing communities, changing the social dynamics inside them. Policies aiming to control coffee rust had failed to address this systemic nature of the plague. Since coffee rust is a disease caused by a fungus the spores need droplets of water to germinate, therefore, it was assumed that shade trees promoted rust by maintaining a more humid environment. Most of the policies have addressed this problem by only perpetuating the "technification" trend from the 90s, which is constantly highlighted by recognized coffee scholars such as Ivette Perfecto and John Van der Meer as one of the causes of the spreading of the coffee rust (Lin et al., 2008). The main mechanisms observed by Perfecto and Van der Meer in their studies were plague control and the introduction of novel coffee varieties. Technification consists in planting higher-yielding coffee varieties, eliminating or considerably reducing the shade trees in the plantation, and applying agrochemicals, mostly synthetic fertilizers, and herbicides. This led to the reduction of biodiversity in coffee plantations and the alternative sources of food that came from shade trees and herbaceous plants growing beneath them (Perfecto et al. 2019). Traditional or rustic coffee plantations are a source of food for families owning them, the fruits produced by the shade trees are included in the diet of these families and sometimes sold in local markets (Jha, 2011). These policies have tackled only the spread of disease, overlooking the underlying nutritional deficiencies causing the coffee plants' inability to resist coffee rust infestation (personal interviews, 2021). On the other

hand, coffee rust has been seen as an excuse to promote technological packages (high-yielding novel varieties, shade reduction/elimination, and synthetic fungicides and fertilizers) despite the lack of scientific evidence to assure that shade elimination could control the disease (Perfecto et al. 2019). Shade trees are vital in maintaining healthy soils and plantations: they add nitrogen to the soil, are weed suppressors, buffers of microclimatic extremes, and increase the diversity of natural enemies helping to control pests. Also, the use of synthetic pesticides impoverished the soil and eliminated the plant diversity existing in traditional coffee plantations. These actions contributed to increasing the already existing vulnerability caused by the liberalization of coffee markets and the failure of the International Coffee Agreement in 1989. The before-mentioned actions were part of the strategies included in the main coffee subsidies in México. The main policies responding to coffee rust and the market's volatility prices (from 2012 to 2018) consisted of monthly or one-time payments to coffee producers (depending on the type of support requested: training, production supplies, mainly pesticides and fertilizers or money transfers for coffee producers, as a stimulus to production) given through coffee organizations (Villanueva, 2022). The use of pesticides to control the coffee rust outbreak was widely spread thanks to the government's subsidies for these products. These policies have been designed to target individual producers, overlooking the fact that most of them were already organized in associations and had already experience as policy entrepreneurs. INMECAFE (which disappeared in 1989) strategies trigger coffee producers' organization and collective action. Another set of strategies that surged as a response to the declining prices of coffee in Veracruz, is the promotion of coffee consumption at the local level.

Data on policies for the coffee sector, show a raise in the support to coffee producers for entering the market of specialty or differentiated coffees, including organic and fair certifications was seen prominently during and after the coffee rust crisis, amongst the promoted strategies to face the existing challenges on the coffee sectors. The government included in its policies, a certification subsidy for small producers (SAGARPA, 2016). Lately, this has continued through trainings and workshops as well (SADER and SEDARPA, 2021 personal communication). During the last 3 years, the support to coffee growers, provided by the federal government and aiming to support half of the coffee growers in the country, has consisted of direct yearly money transfers to less than a third of the more than 500, 000 coffee growers in Mexico, according to several coffee organizations (Villanueva, 2022). According to government data, loans for the agricultural sector (small-scale production, agroindustry, commercialization, and services involved in the value chain of the agricultural sector) dispersed through technology agencies and banking and non-banking financial intermediaries, increased in the last year. One of the most prominent strategies during the last three years was the exclusion of many of the previously existing coffee organizations as intermediaries for the dispersal of the yearly financial support to coffee producers. This has also been replicated in terms of policy discussions, where dialogue between these coffee policy entrepreneurs and the government has been interrupted in some cases, which has made governance in the coffee sector even more complex than before. Despite the investment in loans for the agricultural sector, interviews with former agents of the financial institutions implementing these policies showed how in the State of Veracruz, the loans were difficult to fully allocate, due to restrictions in personnel,

and bureaucracy changes (personal interviews, 2021). Policies aiming to specifically support agricultural producers, and even less, coffee producers' livelihoods and well-being, weren't enacted. This has been partly attributed to the gaps left by the lack of personnel added to the exclusion of the coffee associations and groups in Veracruz. Beyond the policies established at the national level, programs supporting education, childcare, health, and social security, haven't been reported either in academic or practitioners' publications (see for example CEDRSSA, 2018; Hernández Sánchez et al., 2021; Hernández Sánchez & Nava Tablada, 2019) for the coffee sector during and after the coffee rust crisis. There has been a price risk managing program, which: "is oriented to protect the income of producers and/or the buying cost of agricultural products and promote a financial culture of price risk managing in the sector" (SADER, 2019). Despite the existence of this policy, it hasn't particularly been mentioned in the academics or the practitioner's literature. The before-mentioned policies view productivity and competitivity, as the way to solve and face the different challenges posed by the coffee crises. It fails to integrate the view of all the stakeholders in the coffee sector, including the ones with contested interests. As stated before, undermining the systemic effects of the coffee rust, hindered not only the interlinked causes of vulnerability in coffee-producing communities and regions but also the importance of understanding the relevance of the many stakeholders involved in coffee production and their level of inference and agency. In other words, the central role of governance in coping with this shock was undermined.

For this reason, this dissertation proposes antifragility as a policy approach to achieve the Safe and Just Space, because this perspective focuses on how systems

thrive through policy learning during crises. Several scholars call for innovative and integrated governance approaches in dealing with the complexity posed by shocks and crises, such as the ones caused by climate change (Djalante, 2012). This dissertation responds to the issue of the lack of policies and strategies that address social, ecological, and economic causes of vulnerability in the coffee region of Veracruz. Moreover, antifragility governance assessment analyzes the reactions to coffee rust of scale-differentiated and agency-differentiated heterogeneous stakeholders in policy communities. This constitutes the evaluation of the policy implementation and its normative coherence facing this specific shock.

Defining and applying antifragility

The antifragility perspective and its applications and uses have derived mainly from Taleb's original definition: antifragility is the ability to benefit from changes caused by shocks and crises and thrive (Taleb, 2017). By drawing on the concept of Taleb (2017) Equihua and colleagues' definition brings antifragility to the field of ecology, by defining an antifragile ecosystem as one that benefits from variability; antifragility goes further than robustness or resilience because antifragile structures not only withstand stress but also benefit from it (Equihua Zamora et al., 2019)Despite antifragility offering a vision of opportunity windows brought by shocks, it is a highly institutionalized approach (Blečić & Cecchini, 2019b; Botjes et al., 2021).

Policies are only viewed as governmental regulations. Taleb uses several examples to explain antifragile systems and advocates for them as ideal types but in his pursuit of antifragility two fundamental aspects are missing: scale and power (these considerations are integrated in PCD approaches which aim to mitigate inequalities (see OECD, 2019)). Taleb's view doesn't acknowledge the complexity

of policy frameworks. In this dissertation, I incorporate policy networks into the analysis. Policy networks as diverse coalitions of stakeholders mobilize to realize policy change (Häbel, 2020; Koff, Villada Canela, et al., 2022). This mobilization occurs at different levels of governance.

So far, antifragility has been used in engineering, urban planning, and managerial sciences, focusing on a set of top-down decisions and actions (Blečić & Cecchini, 2019a; Botjes et al., 2021; de Bruijn et al., 2020; Tokalic et al., 2021). For example, Botjes and colleagues (2021), identified twenty-two antifragility attributes of organizations as key factors to ensure their survival facing unexpected shocks. This systematic analysis leading to a comprehensive list is a useful instrument since it provides insights in the characteristics of resilient and antifragile organizations. It provides attributes that are useful in designing organizations. Despite its utility as guidelines, this list can overlook the dynamics of organization governance and constrain creativity by listing, for example, some characteristics that depend on power dynamics such as skin in the game, which implies taking highly risky decisions, despite the consequences this might have.

I recognize the worth of the scholarship produced on antifragility, in the sense that they explore ways of understanding how to better respond to crises (see Blečić & Cecchini, 2019b; Botjes et al., 2021; Notarstefano, 2022) but I acknowledge the limitations of these studies when it comes to grounding antifragility in terms of governance and policy implementation in the sustainability field. Building on the work of antifragility scholars, resilience, and earth governance systems, as defined in previous chapters, I operationalize antifragility through the definition and implementation of five characteristics: diversification, interconnectivity/Complex

systems thinking embracement, flexibility, polycentric governance and finally learning, more specifically, policy learning. I refer to embracing systems thinking and acknowledging interconnectivity as the capability of taking into account that in social-ecological systems, changes in one component of the system, despite the amount or variable that change, have cascade effects, affecting other components of the SES. Diversification is understood in this dissertation as the implementation and inclusion of a variety of economic, productive, and collective action strategies, as well as the inclusion of different types of stakeholders in policy networks. Flexibility is the capability to adapt in the short term to the context in terms of time, territory, and social, economic, and environmental conditions. Polycentric governance is defined in this dissertation as a type of governance with multiple centers of decision-making, each of which operates with some degree of autonomy. It not only refers to the existence of horizontal and vertical ties across scales -as multi-scale does-, but it also encompasses a variety of policy-generating origins across all types of institutions (regional governments, municipalities, private, political parties, commercial companies, etc.) (OECD, 2019; Roe, 2009). Learning is understood as the change in structures, mechanisms, and policies responding to how new knowledge is integrated.

Antifragility for a safe and just space in practice

This dissertation implements an antifragility framework to examine policy responses during the rust crisis to see how decisions were made in response to this perturbation and by whom. By adopting this approach, the analytical model proposed here aims to explain any potential shift in policy frameworks between T0 and T2 (see chapter five above) and it examines crisis response dynamics only during T1.

I adopt a dynamic view of public policy as a system in which a plurality of actors engages in exchanges at different levels (Häbel, 2020). For these reasons, this dissertation examines antifragility and three levels of policy engagement and governance in Mexico. The first examines government responses to crises which represent traditional approaches to antifragility. Second, this dissertation examines policy entrepreneurs, defined as interest organizations that promote or block policy innovations through social mobilization. Third, antifragility is addressed through practice at the grassroots level focusing on citizens. Since the study examines coffee production, the analysis presented here includes coffee producers in central Veracruz.

This dissertation posits that the presence of antifragility characteristics during crises promotes policy learning which is fundamental to the establishment of normative coherence for the safe and just space (NCFSJS). Chapter five has indicated that there have been limited changes in levels of NCFSJS between the state development plans in Veracruz, one before coffee rust became a widespread crisis (T0) and one after (T2). This chapter, which focuses on governance during the crisis (T1) examines the characteristics of responses to the rust crisis while it actually happened at three levels of policy engagement and governance: government, policy entrepreneurs, and citizens (producers). The chapter studies the presence or absence of antifragility characteristics in initiatives at all three levels of policy-making systems. It seeks to understand where antifragility is heightened and where it is lacking. This way, the analysis can investigate at which level policy learning occurs and where it is limited. The data from which this analysis derives came from 62 semi-structured interviews conducted with 56 stakeholders including those specialized in

coffee sector governance and policies, government officials, members of NGOs, small, medium, and large coffee producers, and retailers, CEOs of large coffee trading companies and beneficiaries of government agricultural and coffee subsidies from Veracruz's coffee producing regions.

Some interviewees belonged to more than one category. The number of interviewees per category is detailed in table 19.

Table 19. Number of interviewees per stakeholder category and sub-category (source: author's creation).

Category of stakeholder	Sub-category of stakeholder	No. interviewees
Government (policymakers)	Former government officials	6
	Incumbent government officials	16
Policy entrepreneurs	Scholars	3
	Coffee traders	4
	Practitioners (NGOs)	16
	Consultants	2

Citizens (coffee and agricultural producers)	Beneficiaries of state subsidies	2
	Coffee producers	13
Total		62

The results present below illustrate scores for each antifragility characteristic, but they also provide overall scores per type of stakeholder. When a stakeholder reaction was identified as counteracting an antifragility characteristic a -1 was assigned based on the criteria presented in table 6 of chapter 4. When a stakeholder reaction was identified as reinforcing an antifragility characteristic a +1 was assigned based on these same corresponding criteria, and finally when there was no mention of the antifragility characteristic a 0 was assigned. This was done by adding labels strengthening + antifragile characteristic 1, 2, n… and counteracting + antifragile characteristic 1, 2….5 + type of stakeholder to selected sections of the interviewees' discourse using MAXQDA (see table 20).

Table 20. Example of labeling of antifragility characteristics. Source: made by the author.

Interviewee	Type	Characteristic	Citizen	Policy entrepreneurs	government
GOVO11	government	Flexibility	-1 Quote: [adoption by coffee growers] is not easy in terms of agroecological practices, agrochemical use became ingrained in a lot of places, especially in mestizo communities, there's a love for pesticides"	+1 Quote: "CAFECOL (regional coffee organization) participates in dialogue about coffee policies and brings together producers, so their needs are satisfied by the government programs and strategies"	-1 quote: [with the government] is difficult to be flexible, dialogue is promoted but changes in the goals of the programs are not admitted"

Amongst the different stakeholders, responses to coffee rust have been diverse as table 19 shows. Government stakeholders had no specific response to coffee rust in terms of social equity, not having implemented policies such as family subsidies, unemployment insurance, and childcare, and neither participatory policy formulation nor monitoring. Therefore, coffee producers haven't been the subject of any social equity-related policy, as a response to coffee rust. Policy entrepreneurs are the stakeholders pushing for participation in policy design and monitoring, trying to make governance less centralized. Economic protection was mostly promoted by the policy entrepreneurs, but these resulted in few policies implemented to reduce the exposure of coffee producers to market volatility for example. Subsidies for coffee production weren't timely nor sufficient to address the rust crisis and the lack of crop insurance contributed to the vulnerability of coffee producers. A similar thing happened with the certified and specialty coffees, that was also promoted in policies implemented by the government.

The promotion of diversification of plantations such as agroforestry plantations in which the shade trees also produce edible fruits and potential income sources was mainly supported by the policy entrepreneurs and well accepted by coffee growers. The protection of shade coffee plantations, recognized in the state laws, was a response largely coming from policy entrepreneurs and embraced by the government. Nevertheless, ecosystem services programs in coffee plantations have been less and less throughout time, creating a contradiction between the protection policies and the production policies.

The social equity arena of the safe and just space was the less important in terms of policy responses to the coffee rust, whereas the most privileged one was

the planetary boundaries. This imbalance shows that overall, policies did not appropriately respond to the crisis.

Table 21. Coffee rust-crisis responses in Veracruz based on characteristics of antifragility for social equity.

Arena of Safe and Just Space	**Antifragility characteristic**	**Responses**	**Citizens**	**Policy Entrepreneurs**	**Government**
Social Equity	Flexibility	Family Subsidies	0	0	0
		Unemployment insurance	0	0	0
		Childcare	0	0	0
	Polycentric governance	Participation in the coffee policies process	0	1	0
		Dynamic and participatory policy monitoring	0	1	0
Mean value			0	0.4	0
Mean overall value			0.1		

Table 22. Coffee rust-crisis responses in Veracruz based on characteristics of antifragility for economic protection.

Arena of Safe and Just Space	**Antifragility characteristic**	**Responses**	**Citizens**	**Policy Entrepreneurs**	**Government**
Economic Protection	Flexibility and learning	Crop Insurance	0	0	0
		Local distribution networks	1	1	0
		Price Guarantee	0	1	0

		Accessible loans	0	1	0
		Sufficient coffee subsidies	0	0	1
	Diversification	Timely coffee subsidies	0	0	0
		Certified coffee markets	1	1	1
		Specialty coffee markets	1	1	1
Mean value			0,4	0,6	0,4
Mean overall value			0.5		

Table 23. Coffee rust-crisis responses in Veracruz based on characteristics of antifragility for planetary boundaries.

Arena of Safe and Just Space	Antifragility characteristic	Responses	Citizens	Policy Entrepreneurs	Government
Planetary Boundaries	Interconnectivity and diversification	Agroforestry plantation	1	1	1,00
		Organic coffee plantations	1	1	0,00
		Shadow coffee plantations protection	0	1	1,00
		Ecosystem services programs	0	1	0,00
Mean value			0,5	1,0	0,3
Mean overall value			0.6		

The empirical analysis conducted through the antifragility governance for the safe and just space as a reaction to coffee rust is presented in the two tables below. Table 24 presents the overall scores for each of the antifragility characteristics and type of stakeholder/level of engagement. Table 25 shows the overall antifragility governance scores for each level of engagement. Finally, the third table shows the overall scores for each antifragility characteristic. We calculated the mean to have the aggregate scores in the three tables.

Table 24. Antifragility for the safe and just space for each antifragility characteristic and stakeholder type as a reaction to coffee rust in Veracruz.

	Citizen	**Policy entrepreneurs**	**Government**
Diversification	1	0.7	0.1
Interconnectivity	0	0.6	-0.2
Flexibility	1	0.7	-0.3
Polycentric governance	0	0.6	-0.3
Learning	1	0.6	-0.5

Table 25. Antifragility for the safe and just space for each antifragility characteristic as a reaction to coffee rust in Veracruz.

Antifragility characteristic	**Score**
Diversification	0.5

Interconnectivity	0.2
Flexibility	0.3
Polycentric governance	0.2
Learning	0.2

Table 26. Antifragility for the safe and just space for each stakeholder type as a reaction to coffee rust in Veracruz.

	Citizens	**Policy entrepreneurs**	**Government**
Overall antifragility	0.5	0.6	-0.2

These coefficients show important trends. Whereas citizens show individually the maximum levels of three antifragility characteristics: diversification, flexibility, and learning, the government is the one that performs the poorest in all the characteristics. On the other hand, policy entrepreneurs' scores are close to the maximum level.

In terms of the coefficients for each of the characteristics, it is clear that the most reinforced is diversification. As shown by the interviews, diversification happened in two ways: changing management strategies of the coffee plantations (such as the introduction of fruit-producing shade trees) and changing and/or including more productive activities. Eliminating shade trees in coffee plantations and introducing rust-resistant coffee varieties as well as fertilizing coffee plants were the main changes coffee growers introduced. This is confirmed by Perfecto et al. 2019. The 2012 coffee rust outbreak led to the introduction of new high-yielding coffee varieties, and the elimination of shade since it was thought to promote rust spreading and fertilizing plants, mostly with synthetic

products. These same strategies were the ones promoted by the government. The specific subsidy for coffee producers, implemented during the rust outbreak, the Programa de Apoyo a Pequeños Productores componente café (Subsidies Program for Small Producers, component coffee -PROCAFE for its initials in Spanish), gave synthetic fungicides, fertilizers, and plants of novel coffee varieties (Reglas de Operación Del Programa de Fomento a La Agricultura de La Secretaría de Agricultura, Ganadería, Desarrollo Rural, Pesca y Alimentación., 2013personal interviews 2021), boosting the before-mentioned strategies implemented by coffee producers. Coffee producers mentioned the need to perform activities mainly in the tertiary sector to ensure their livelihoods (having to be construction workers, taxi drivers, and clerks at supermarkets, mostly not in their communities but in the closer cities). It was prominently mentioned that coffee production was not economically sustainable, therefore a need to diversify income sources. Despite the increase in the budget allocated to government loans for the agricultural sector, the reduction of personnel and budget for operations of one of the main financial government agencies for agriculture and fisheries, and the difficulties that producers face to get the loans due to the number of requests and conditions to be met, the spread of this financial resources through loans was low (personal interviews, 2021). The devastating rust outbreak in Mesoamerica led to scarce work for people that depended on coffee plantations for family subsistence. Following the rust outbreak in 2021, a reduction of 45% of seasonal jobs in the coffee sector happened (Perfecto et al., 2019). On the other hand, a third diversification strategy was present in the discourse of the interviewees: entering to the differentiated coffee markets. This was the widest change promoted by policy entrepreneurs and finally adopted by some government

officials. Coffee differentiated markets demand a strict control of the whole production process: for the organic markets the production supplies have to be biological, and the manufacturing has to meet specific criteria from the decortication of coffee beans to the toasting. Ramos Rivera et al., 2021 contend that entering to the differentiated coffee market has been the main response of policy entrepreneurs and organized coffee growers to the privatizing politics that have negative effects on the coffee-producing regions.

Interconnectivity, polycentric governance, and learning are the lowest-scoring characteristics. The links between the social, economic, and environmental spheres of SES were barely mentioned, on the contrary, for example, by giving more importance to the economic sphere, most of the interviewees mentioned actions that had negative effects on the other spheres, such as the technification of the coffee plantations, mostly harming the environment and changing the social relations in their communities. This is evidenced by how the rust problem wasn't properly framed as a systemic shock, a situation that repeatedly happened, especially in the case of the government (personal interviews 2021). The lack of coordination between different government ministries and officials when it comes to designing, implementing, and monitoring public policies for rust, evidenced the logic of working in silos. As shown in table 19, social policies were the less promoted and implemented in general. Unemployment raised in the coffee regions in Veracruz and people depending on coffee production was not compensated with any kind of subsidy. The same happened with family subsidies and childcare subsidies which weren't present in the discourse of the interviewees, showing that the responses to the rust crisis, didn't tackle some of the causes of vulnerability in coffee communities. Public

policies responding to plagues and diseases, originated in the green revolution have triggered heavily intensive production, overlooking the negative effects of such policies, causing a reduction of at least 20% of the global surface of agroforestry systems like shade coffee plantations (Jha et al. in Libert-Amico & Paz-Pellat, 2018). This dissertation promotes antifragility as a way of tackling the challenge of downscaling the safe and just space in the governance field. Downscaling global models such as the doughnut model intensifies the existing challenges around different parts of the policy cycles such as goal setting and monitoring since it requires that goal setting is informed by an understanding of context-specific social and ecological trends and how they interact to influence local and planetary outcomes (Turner & Wills, 2022). The results of this analysis of the notion of interconnectivity prove that this challenge is present in Veracruz since it shows how actions proposed are not contextually appropriate nor do they acknowledge the deterring effects of adopting specific agricultural techniques on the environment and social life of coffee-producing communities.

As I have stated before, polycentric governance implies a multi-level engagement of stakeholders at different levels of power, interest, and influence in decision-making processes. The fairly low score of polycentric governance shows how policy communities are not diverse nor broad in the coffee sector of Veracruz. Whereas interviewees described how most policy entrepreneurs participated in policy discussions with the government, even promoting the inclusion of coffee growers in the dialogue of coffee policies design, they also show their frustration in this regard, highlighting that these discussions have not crystalized in improvements in public policies and strategies to foster the coffee sector. They talk about informal spaces of dialogue and collaboration.

Discussions held by the government, policy entrepreneurs, and coffee growers, can have two outcomes. In the best-case scenario, they can lead to the modification or the creation of a new policy (law, subsidies program, norm, consortium) that partially responds to the needs of the different stakeholders that make up these policy communities. In the worst-case scenario, the dialogue isn't institutionalized. In the case of an impact in policies, their implementation is restrained by financial incoherences (lack of budget), lack of social capital (not enough personnel), and non-compliance with the institutionalization established in laws, -as institutions dictated by Veracruz's coffee law haven't been created yet (Velazco, 2022), and a misalignment between the biological cycles of coffee plantations and the time frames of the policies. The subsidies weren't timely or sufficient, as table 19 shows.

Government showed a very low score in terms of flexibility and learning. Dialogue between coffee producers as beneficiaries of subsidies was not fully open which made it difficult learning (personal interviews, 2021). Even though, knowledge exchange was one of the mechanisms mentioned in the paper of one of the most important agricultural policies at the moment (Sembrando Vida), its implementation was through the "teaching" and training of producers by technicians, more than an exchange between them. This made it difficult to adapt the strategies proposed by the program to the local conditions, making evident the lack of flexibility and learning (personal interviews, 2021) and hindering innovation processes. This is proven to be prejudicial for the development of creative solutions to problems (Newig et al., 2018).

The trend of a low score of polycentric governance and interconnectivity shows a lack of individual learning and policy learning. By not acknowledging that the social,

economic, and environmental are interconnected, therefore, responses in one of these spheres lead to changes in the rest of them. The perpetuation of the same strategies to tackle coffee rust, without an appropriate systemic and multi-level view, demonstrates a lack of learning, as Perfecto et al. 2019, demonstrate. Not properly addressing the needs and views of all the stakeholders involved in the coffee sector, policy reactions were not appropriate to face the rust crisis. This made evident that there was very little or no policy learning. Discourses of interviewees are framed in polarized ways: traders and big producers advocate for the technification of coffee production and are supporters of precision agriculture, defined as a sustainable way of production that can target rates of fertilizer, seed, and chemicals for soil and other conditions reducing losses from excess inputs applications and from the reduction of losses due to nutrient imbalances, weed escapes, insect damage, etc. (Bongiovanni & Lowenberg-Deboer, 2004). The downside of how precision agriculture is framed is that it promotes monocultures of coffee: fields without any other plant species, even do, there is compensation by leaving areas of natural forest untouched. Industrial coffee traders and big producers also embrace the concept of optionality: policies should encourage coffee growers to choose what is best for them and support these choices based on their capabilities, in terms of the type of plantation they want (shade or open, intensified or traditional) and the level of specialization of the coffee (differentiated or not) and finally their level of participation in the coffees' value chain (for example, from production to coffee cup or only production). On the other hand, policy entrepreneurs coming from coffee-producing associations and civil society organizations, reject this narrative and confront them by demanding support for promoting shade coffee production, differentiated coffees, and the engagement of

coffee growers throughout the coffee value chain. This is presented in governmental actions and discourses that tend to be contradictory. On one hand, agroforestry plantations are widely promoted through workshops and capacity building. This shows how the government is experimenting with “market-driven” approaches to agriculture (World Bank, 2007 in Florini & Pauli, 2018) aiming to, as contended by Florini and Pauli, connect business and smallholders agricultural producers with NGOs and claiming to simultaneously address productivity, environmental conservation, and poverty alleviation (Florini & Pauli, 2018). On the other hand, associationism is highly discouraged by cutting out NGOs and mostly civil coffee organizations from the knowledge and financial flows, under the argument of existing corruption in all of them. This affected the capability of coffee growers to have access to additional financial and material resources to the regular coffee subsidies. The policy entrepreneurs had a critical role in supporting coffee growers to get additional resources to satisfy their needs and fill in the gap that the government left (personal interviews 2021).

Finally, the overall scores of antifragility show that the government is the one hindering antifragile governance and therefore implementation coherence of policies for a safe and just space in the coffee sector. The government did not effectively respond to coffee rust, a lack of policies especially in terms of social equity was evident, and no complementary subsidies were given to coffee producers in terms of unemployment, childcare, or family support. For example, agro-industrial producers and international coffee traders seem to have succeeded to ameliorate the lack of social policies in terms of family support and education. By encouraging coffee producers to certify their coffee, to meet the demand of the international coffee traders’ clients, they make campaigns and

programs to stop child labor in the plantations and they build schools and childcare facilities so that children are out of the coffee fields and the producers can be certified as fair trade (personal interviews, 2021).

In the field of governance for sustainable development, the focus has been widespread on the role of subnational action in achieving global goals, “advocating that local authorities promote participatory, community-based and inclusive initiatives” (Turner & Wills, 2022). Policy entrepreneurs were the “bridge” between the government and coffee producers, advocating for more plural platforms and discussions to improve the policies for the coffee sector. Civil associations and non-profit organizations involved in Veracruz’s coffee sector, act as “knowledge holders” (Schmitter, 2002 in Newig et al. 2018) since their engagement in the field at a local level allows them to complement existing models of the government policymakers. These policy entrepreneurs have advocated being included in the dialogue with the government, to represent coffee growers’ interests, while many of these civil associations are formed by coffee growers. Furthermore, in 2018 the law for the promotion, sustainable development, production, distribution, and commercialization of the coffee of Veracruz was published as a response to the crises that the sector faced. Coffee policy entrepreneurs such as regional trade unions and coffee associations contributed widely to this. Policy entrepreneurs mentioned the law as a sign that progress was made to improve the conditions of the coffee sector, but that it was not good enough. Despite the creation of the law which, as mentioned in chapter 5, promotes the inclusion and participation of stakeholders in all the agri-food chains of coffee, the impacts on local policies and the institutionalization of this mandate haven’t been seen yet.

The key role of the government in not reducing the vulnerability of the coffee sector facing several crises cannot be denied, as the evidence provided by this dissertation shows, but it is fundamental to recognize that there is a shared responsibility for the coffee sector crises. On one hand, there is not a unified coffee producers' community or network that can push with enough strength and promote policy changes. The politicization (involvement of political parties) of the coffee policies and the corruption perceived by the growers promotes an environment of mistrust, leading to poor social cohesion and polarization of the sector. This converges with what Newig and colleagues (2018, p. 276) based on Purdy (2012) explain about actors' participation: "[they] tend not to participate when they anticipate manipulation by more powerful participants".

On the other hand, since coffee production hasn't been sustainable for a long period of time (more than 10 years as reported by several interviewees) there's a lack of interest in some coffee growers to participate in coffee policy discussions and adopt new techniques in their plantations. The youth of coffee-producing communities is migrating to the closest cities leading to the aging of coffee producers (personal interviews, 2021). The perdurance of small coffee plantations seems to be rooted in a sense of identity and family tradition more than anything (personal interviews, 2021).

This leads to conclude that Veracruz's state, regional and local authorities have hindered participatory, community-based, and inclusive initiatives by not properly engaging policy communities in the design, implementation, and monitoring of public policies. Policy communities of the coffee sector in Veracruz showed to be diverse (engaging actors from the private sector, civil society, and public -coffee growers- at large), A certain degree of participatory governance, as described by Newig et al. 2018.,

exists in the coffee sector of Veracruz. However, there are still asymmetries in the decision-making process, since not all the participants are afforded the same influence over the decisions to be taken (power delegation to participants -Newig et al. 2018) which can explain the lack of accuracy in the design and implementation of coffee specific policies in Veracruz.

The gaps produced by the lack of a systemic view of the coffee crises and policies resulting from that have been filled by some policy entrepreneurs, mainly big traders, and some associations that put in place actions to trigger social development, through education and capacity building, as well as household support. There is a trend for policy entrepreneurs to move from complementing government policies to substituting them. This is opposite to what Campos and colleagues (Campos et al., 2004) found in their study where the government seeks NGOs to collaborate with them, given their policy failures.

Despite the efforts of policy entrepreneurs mainly to strengthen antifragile responses to coffee crises, as shown in this analysis, there's still a lack of antifragility mainly at the government and citizen levels. This is a window of opportunity and at the same time a concern: for antifragility governance to be sustainable it needs to be promoted at the level of citizens, policy entrepreneurs and institutions. There is a need to focus on critically analytical and responsible citizenship as the foundational building block of antifragility or our ecosystems and states will be vulnerable to perturbations of our own making.

Chapter 7. Conclusions

As stated throughout this dissertation, the world has now been facing several interconnected social, health, ecological, and political crises in recent years: wars and regime shifts, the COVID-19 pandemic, climate change, human migration crisis, and economic distress. These crises, especially the 2007-2008 financial crisis and its effects worldwide and now the COVID-19 pandemic and its consequences have heightened the relevance of the warnings that were raised back in 2015 when most of the world leaders agreed to the Sustainable Development Goals and the 2030 Agenda. Public debates about inequality and environmental conservation got more intense due to the aforementioned events that led to global distress and challenges. As viewed by some scholars such as Sandoval (2022) and Mazzucato (2022), tackling these matters became so urgent that the discourse of politicians transitioned from being cautious to "demand[ing] energic actions to fight climate change, poverty, inequality and reinstate trust in the institutions and deliver again the voice and power to handle of the economy" (Sandoval, 2022). As a result of this situation, the G7 Panel on Economic Resilience panel has called for a paradigm shift in global governance from the Washington Consensus to the Cornwall Consensus (Mazzucato, 2022).

The Cornwall Consensus contends that G7 countries should pledge to uphold 7 principles: solidarity, better risk management, sustainable and purposeful supply, better governance and inclusion. The seven principles point towards a "reform of global economic governance for the common good, common goals and a collective response to crises, coercion and distortions; monitoring, collective assessment and investment in addressing economic, environmental or geo-political risks; collaboration with business for

open innovation-friendly market systems that are resilient to disruptions affecting national, economic or human security; promotion of common global standards, rules and norms for a new economy aligned with the G7 values, promote sustainability, uphold to labor standards, and encourage national and international regulations that strengthen collective economic resilience; and acceleration of investment in the SDGs, promotion of digital inclusion, elimination of tax evasion, and facilitation of full access for developing countries to global markets, alongside national policies that tackle inequality and support traditionally under-represented groups such as women and minorities" (G7 Panel on Economic Resilience, 2021). The Cornwall consensus principles coincide greatly with what Raworth proposes: an economic model that allows development in a way that is regenerative, environmentally sustainable, and socially equitable. It advocates for circular and regenerative design and economic strategies, tax and financial systems reforms to make these sectors green, embracing the markets as a part of the solution, and the state as a key regulating actor ensuring markets are fairer and challenging traditional pro-growth economy. The safe and just space - a space in which humanity thrives without overshooting the planet's capacity to sustain life-, and the doughnut model has been not only embraced by scientists but also adopted by several European capitals, such as Amsterdam, Brussels, Copenhagen, Berlin and Cambridge (Lazard, 2022). The value of Raworth's doughnut is evident: its implementation has been a response to some of the most urgent challenges, such as climate change and growing inequalities. Its worth relies on the easy-to-grasp nature of the model and it has been put in place to address energy and economic transitions aimed at tackling the climate crisis and ecological collapse on one hand and reducing inequity by meeting social well-being standards (such as those

included in the SDGs) on the other hand, amongst others. Raworth's doughnut model in its social foundation advocates for participation and accountability and calls for collective action and collaborations fostering innovative solutions to global problems. Furthermore, in the process of implementing the doughnut in cities, a key aspect is the dialogue between local authorities, citizens, practitioners, and scholars, embracing a bottom-up approach, as the reports from cities such as Amsterdam show (Doughnut Economics Action Lab et al., 2020). Both the Cornwall consensus and Raworth's model highlight the need for further research and collaboration on resilience in global capitalism and global markets. They point out the importance of the discussions between pro-growth and no-growth models of development. This dissertation is timely because it focuses on re-working the doughnut model and specifically the safe and just space as a model for sustainability while it promotes addressing social-ecological vulnerability as a normative focus of policy coherence for sustainable development.

The research questions that are the basis of this analysis are: how can social-ecological systems balance the need for social equity, economic development, and environmental conservation necessary for the achievement of a safe and just space? Specific questions include: how coherent are public policies with a safe and just space (Raworth, 2017) in the coffee producing regions of Veracruz? And do stakeholders at different levels respond in an antifragile way to shocks in agricultural systems?

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(Raworth, 2017) in the coffee-producing regions of Veracruz? And do stakeholders at different levels respond in an antifragile way to shocks in agricultural systems?

Discussion on challenges in coffee social-ecological systems

As mentioned in chapter five, this dissertation views coffee as a system, rather than merely an economic or productive activity/sector. Coffee production is a strategic agricultural activity in Mexico. According to national official data, it employs more than 500 000 people in 15 states (SADER, 2018) supporting the livelihoods of small landholders in rural communities. Besides, its economic value, coffee can have cultural, social, and environmental values. Coffee is culturally important since coffee plantations can be found in indigenous territories in which coffee shrubs are inserted in previously existing agroforestry systems, as part of domestic forests or home gardens, a tradition with indigenous roots. Besides their cultural values, these agroforests are vital for local livelihoods since they provide a myriad of resources other than coffee (Toledo & Moguel, 2012). Coffee agroforests are usually located at higher altitudes in places like cloud forests (Challenger, 1998). As recalled by Contreras and Rosales (Contreras Hernández & Osorio Rosales, 2015) the vegetation structure of coffee plantations, can be similar to that of cloud forests and therefore they host a wide variety of animal and plant species and give ecosystem services (Perfecto et al., 1996; Moguel & Toledo, 1999; Schroth et al., 2004; Manson et al., 2008 in Contreras and Rosales, 2015). The provision of ecosystem services by coffee plantations is especially relevant when they are in the upper parts of the watersheds, where they contribute to water provision (Langle-Flores et al., 2021), filtration and prevention of soil erosion (Philip et al., 2004).

The coffee sector in Mexico has faced several challenges since the end of the 1980s and the start of the 1990s - such as price instability that made small coffee producers especially vulnerable to economic shocks -, but it was in 2012 that coffee rust became a major problem in Mexico, as it was throughout the Americas. This continued until 2018 during which the rust prevalence decreased significantly, as is described throughout chapters one, five, and six.

Limitations of the State Development Plans of Veracruz and normative incoherences

Chapter five shows how the State Development Plans (the plans that guide the sectoral policies and programs at the state level) do not necessarily contribute to the reduction of vulnerability in the social-ecological coffee systems in Veracruz, by privileging certain policy arenas over others. The State Development Plans' social elements show normative commitments to the safe and just space, while the economic sector is lagging. Another well-identified trend in both State Development Plans analyzed, is that social sustainability is privileged at the cost of environmental sustainability. This reinforces policy silos. Despite the recent changes (2019 until now) in government institutions and the treatment of sustainability issues, such as poverty reduction and environmental conservation, there is still a lack of policy commitments that properly address the links between these two objectives. The state of Veracruz, inside the office of the Governance Program, has instituted a council for the implementation of the 2030 Agenda of Sustainable Development. This council has been created as an "instance of coordination between the agencies and entities of the public administration in the state, whose purpose is to coordinate, design, implement, follow up, evaluate strategies, programs, actions, and public policies that ensure compliance with the 2030 Agenda"

(Consejo Veracruzano de la 2030 Agenda & Oficina de Gobierno del Estado de Veracruz, 2019). While the council created a pathway for the implementation of the SDGs, it does not look at the implementation of the linkages nor for the interlinkages between SDGs. In terms of coffee policies, the lack of a response to the producers' needs is confirmed as well by the perception of the coffee producers interviewed during this research which repeatedly mentioned that the main crises, they have faced are price volatility, and the lack of efficient financial and trade mechanisms to face that challenge.

Policy communities' responses to the crises in coffee systems

Coffee policy communities in the state of Veracruz are integrated by policymakers, mostly government officials, policy entrepreneurs such as members of NGOs and associations, and coffee producers. Government responses to coffee rust and the price volatility crises lacked flexibility. Scholars such as Henderson (2019) in their research on coffee producers in Chiapas have found that the State has been heterogenous, relatively flexible, and adaptable when it comes to responding to the needs of coffee producers, letting them choose some of the production supplies. In Veracruz, the coffee producers' perception is that the state has not committed to an open dialogue nor adaptation of their policies for sustainability in local contexts. Furthermore, the claim is that some of the production supplies, such as seeds, coffee plants, and agrochemicals were not adequate for the local context (personal communication, 2021). The producers' perceptions are quite heterogeneous, as they express two opposing narratives inside the agriculture ministry (SADER, formerly SAGARPA): one which is pro-agro-industrialization and the other which is pro-agroecology and small-scale agriculture.

The prominent diversification strategy when it comes to coffee production was the main change sought through the passage of State coffee plantation management. Coffee producers in Veracruz have decided to introduce more intensive production strategies, a similar situation to what Henderson (2019) reported. A process of “robustization”, the change of arabica varieties (the prevailing variety with higher value in the specialized coffee markets) to robusta varieties (widely sought by big industrial coffee retailers) has been reported by producers interviewed in this dissertation, like what Renard found at the country level (Renard, 2022).

Due to the rust, most of the coffee producers changed their priorities when it comes to the type of coffee (specialty/organic) they want to produce. Out of 13 coffee producers, only two of them continued producing organic coffee, whereas the rest had to use systemic products to fight the rust. Organic coffee production, especially of some Timor hybrid varieties is difficult, due to the high supply requirements of these varieties. (Pérez-Fernández et al., 2016: 86; Avelino y Rivas, 2014: 31; McCook y Vandermeer, 2015: 1169 in Henderson, 2019). The shift from organic coffee to conventional production was also highly influenced by PROCAFE, including synthetic fungicides, fertilizers, and plants of novel coffee varieties as part of their subsidies to coffee producers (SAGARPA 2012 and personal interviews 2021). The challenges that organic coffee production presents and the ongoing “robustization” of the region contribute to the dependence of coffee producers on transnational retailers and local intermediaries (commonly known as “coyotes”). The robustization of the region was fostered by multinational companies such as Nestlé so they can meet global market demands. This is translated into low and volatile prices for the coffee harvest, which puts coffee-growing communities’ incomes at risk and makes

them more vulnerable financially. Despite the difficulties of organic production and coffee certification, one of the government's strategies in the coffee sector has been to provide technical and material support to small coffee growers in order to get coffee certifications and enter the differentiated coffee market. This has been implemented through workshops to get organic, 4C (Nestlé's certification), and fair-trade certification, especially coming from one of the heads of the Ministry of Rural Development (SADER for its initials in Spanish), which has promoted the adoption of agroecological techniques in coffee plantations (personal interviews 2022). Coffee certification and labeling can improve livelihoods and promote environmental conservation and social equity in coffee-growing communities (Leigh Taylor, 2004); they "operate at the boundary between globalization processes which put market interests first, and localization commitments which prioritize people and development" (Leigh Taylor, 2004, p. 129). "They lie at the heart of social, environmental and political challenges which involve getting the tradeoffs right for sustainable development'' (Bass, Markopoulos, & Grah, 2001, p. xi, in Leigh Taylor, 2004 p. 129).

Since coffee certification and labeling can directly influence the livelihoods of coffee producers and their communities, these instruments must be taken cautiously as an approach to the aforementioned problems that coffee-growing communities face. Some certifications, such as 4C, define sustainability leaving open a wide margin for interpretation that can create competition between the different values they promote. For example, increasing productivity counteracts biodiversity protection and prices paid to producers are lower since the most productive coffee variety has a low market value (Renard, 2022). As pointed out by scholars such as Valkila and Nygren (2010), fair trade

had one of the “strongest standards of social justice among the major coffee certification schemes” since it supports democracy in producers’ organizations, minimum payment prices, improvement of social development and labor rights and it facilitates long-term trading relationships (Muradian and Pelupessy 2005; Raynolds, Murray, and Heller 2007 in Valkila & Nygren, 2009, p. 2). Scholars addressing fair trade have suggested that it can increase producer’s resilience to shocks and reduce their vulnerability, by improving as well, their organizational skills (Bacon 2005; MacDonald 2007; Murray et al.2006; Raynolds et al. 2004 in Valkila & Nygren, 2009), while at the same time, criticisms have been raised because of the dependency that this creates on third-party verified certifiers and traders (Freidberg 2003; Mendoza and Bastiaensen 2003; Mutersbaugh 2005 in Valkila & Nygren, 2009). This can potentially impair the capacity of fair trade to empower producers and reduce power asymmetries already existing in conventional coffee trade (Daviron and Ponte 2005; Guthman 2007; Renard 2005; Taylor 2005 in Valkila & Nygren, 2009). Valkila & Nygren (2009) in their study of coffee-producing communities in Nicaragua have found how Fairtrade has had economic benefits for producers since certified coffee is higher in price. Nonetheless, since only 30-60% of the production can be sold as Fairtrade, these benefits are limited. Another advantage of Fairtrade that they have found is the “facilitation of desperately needed credit for small coffee growers in situations where other sources of credit have not been available” (Valkila & Nygren, 2010). On the other hand, they found that globalization consolidated a buyer-driven market chain in which the larger retailers have much more power against small producers (Daviron and Ponte 2005 in Valkila & Nygren, 2009). In the case of Veracruz’s coffee-producing communities, something similar happens. Whereas the current government

has pushed for an integral view of agriculture and promoted certifications, as well as the integration of coffee producers in all the steps of the value chain of coffee production, two main issues haven't been effectively addressed: financial aid and trade.

Finally, one of the most relevant responses from the State of Veracruz was the publication of Veracruz's state law on coffee, but as mentioned in chapter five, without the implementation of the commitments made in it, only little normative progress can be made. The normative efforts made by the state government remain mainly insufficient when they are not embedded in other institutional frameworks that focus on the interlinkages between policies behind structural and systemic causes of coffee crises.

Filling the gaps in policy frameworks: policy entrepreneurs' responses

Policy entrepreneurs in the coffee sector have had different approaches to the issues of financial aid and trade. Grassroots coffee organizations such as CAFECOL have developed their certification and joined other organizations to create trade networks and access new markets. On the other hand, agro-industrial producers and big retailers (national and multinational) have promoted existing certification and labeling amongst their coffee bean suppliers. This enables them to reach other markets since their suppliers still must go through them as intermediaries because of the contractual relationship between big retailers and bigger companies such as multinational ones.

In terms of financial and development aid, this is often viewed as a win-win strategy: by providing loans and facilitating small producers' access to microfinancing from international organizations, they ensure their supply and provide financial safety for the small producers. Development aid is facilitated by them thanks to their commercial

ties to other retailers and certification consultants. Most of the development aid, such as health and education programs aim to meet the standards established by certifications and labels that they want to maintain for their coffee. Therefore, they must be sure that these standards are met throughout the value chain of coffee. At the same time, they contribute to improving the living conditions and livelihoods of the coffee-growing communities in which they have coffee bean suppliers. As mentioned in chapters five and six, despite the efforts and programs of loans, crop insurance, and financial aid to coffee growers, still less than half of the coffee producers at the state level are targeted by these programs (Molina, 2020). Adding to that the lack of simplification of the bureaucratic processes to access financial aid as well as the reduced resources for the government agencies in charge of this– mainly due to cuts in the budget, leading to a reduced workforce- the placement of these aids and loans has been difficult (personal interviews, 2021). This has led to the need for small coffee producers' need to rely on retailers for financial and even development aid. Certifications are an example of private standards, considered by scholars as regulatory instruments that work as "soft laws" (Henson 2008 in Renard, 2022). Standards conform to codes of conduct that producers have to follow in order for the certification to be granted. According to several scholars, standards are the basis for the organization of many agri-food chains (Loconto and Busch, 2010; Renard and Loconto, 2013; Renard, 2022). Standards respond to consumers' values and demands, which results in a wide variety of coffee qualities. To guarantee this variety, multiple certifications with their respective standard have emerged, including voluntary codes of conduct, so the market needs are met. The segment of specialty coffees has become so successful that, what was originated by NGOs, led

multinational corporations to join them or create their codes of conduct. The power of these big corporations has been transferred to the new specialty coffee segments, reinforcing the dominance of actors in the agro-industrial coffee chain and their control over the other actors in the chain (Renard, 2022). In Veracruz, there are two widely known and contrasting examples of this: the 4C Nestlé label and Oikos, developed by the Agroecological Coffee Center (CAFECOL for its initials in Spanish). 4C (the Common Code for the Coffee Community) is a sustainability standard aiming at anchoring sustainability in coffee supply chains in which independent third-party audits the compliance with sustainability criteria of coffee production and processing in the economic, social, and environmental dimensions (4C Services.org, 2021). Despite its aim, a decoupling between the intended outcomes and values promoted and the reality of its implementation has been found in some coffee regions in Mexico. Scholars such as Renard (2022), have reported a disparity in terms of local social organization, economic growth of coffee-growing communities, and biodiversity conservation, where the standards of 4C have been met but have not necessarily brought major benefits to the coffee producers. This has contributed to growing inequity inside the coffee-growing communities and between them and their counterparts in other regions and segments of the coffee value chain. In Veracruz, it is common to find third-party actors that are trading intermediaries and audit the producers. These intermediaries are mostly medium-sized coffee retailers (sometimes with their coffee plantations as well) that facilitate technical training for the producers to meet the 4C standards. 4C certification is often the first step on the ladder to stricter labeling such as Rainforest Alliance certification (personal interviews, 2022). It becomes controversial when the recommendations made by the

intermediaries are towards “robustization” that treats environmental sustainability and lowers the profits of the producers, even if it provides a safe payment for the harvest (personal interviews, 2022). The installation of an industrial plant in the seaport of Veracruz reinforced the certification and trade networks of Nestlé to expand (Renard, 2022; Rodríguez, 2022; Nestlé, 2020). On the other hand, Oikos is the certification by CAFECOL, a local coffee association that brings together practitioners, small coffee growers, associations, and academia. CAFECOL aims to “ensure that coffee-producing families take root in their communities, territories, and regions with a dignified life, so that, with their coffee forest agroecosystems, they produce a high-quality bean with high added and commercial value; with a variety of products that protect the regional biocultural heritage, the functioning of mountain ecosystems and their environmental services, on which the foundation of the regions, states, the country and the planet itself depends” (CAFECOL, nd.). Oikos is their certification which was built hand in hand with local coffee producers from the Xalapa-Coatepec region and the central Veracruz region. CAFECOL has been characterized by its intensive work to shorten the trading chain of coffee, linking mainly small coffee producers to buyers and retailers. CAFECOL was originally conceived by a group of ecology scholars, practitioners, and coffee producers. It has created a network of 50 national coffee roaster associations and together with its associated producers won the National Cup of Excellence. It is also a member of the Coffee Quality Institute (Imagen de Veracruz, 2022). Despite the existence of certifications and labeling that contribute to coffee growing communities’ development by helping them to avoid “coyotes” and other types of intermediaries that most of the time take advantage of the coffee producer’s need to sell their harvests, certified or specialty coffee is not fully placed

in the market. The demand for this type of commodity is lower than what coffee producers obtain, making it difficult for the return of the resources invested to comply with the certification's standards (Renard, 2022; Taylor Leigh, 2005; personal interviews, 2022). There's a general perception and an evident obstacle caused by the lack of regulation instruments in coffee policies to ensure a consistent market in which coffee, as well as other agricultural products promoted by the government's emblematic programs such as Sembrando Vida, can be sold. This reduces the motivation of the producers to join the government programs and engage in certification processes and endangers the long-term permanence of the programs themselves. Even when producers do join these programs, and there is a component of the latest sectorial programs of agriculture on improving the organizational capacities and rural economic organization of communities (Secretaría de Desarrollo Agropecuario, 2019), the lines of action and their implementation are still targeting individuals, not communities.

The normative pathway to thriving coffee social-ecological systems

As shown in chapter five on normative policy coherence for a safe and just space, responses to increasing coffee production were found at the cost of environmental protection. Systemic viewpoints were mostly absent in the governments' responses to coffee rust. In terms of coffee producers' mobilization and organization, the main strategy has been to engage previously existing associations and NGOs to face the challenges that the coffee crises have brought to producer communities. Scholars such as Henderson (2019) have noted that policy entrepreneurs have filled up the institutional gaps left by the disappearance of the INMECAFE, through technical training, procurement of production supplies, and trading networks, as well as acting as bridges between

financial banking intermediaries and coffee producers. I have also identified that there is still a lack of social cohesion among coffee producers, something that has deepened the disparities in terms of access to financial and production resources, compared to other coffee-producing regions or other agricultural producers in the state. While there are strong coffee associations in Veracruz such as CAFECOL, differences between coffee producers are hindering the strength of the sector and its capability to advocate for more adequate policy solutions for the safe and just space in coffee systems. The lack of specific policies focused on coffee-growing communities targeting systemic causes of poverty and inequity is a gap that remains to be filled. The efforts made at the national and state level to mainstream the economic, social, and environmental values of sustainable development through the agricultural policies, presented in programs such as Producción para el Bienestar, have somehow hindered the importance of social policies targeting the most marginalized communities, those most isolated from trading points due to for example a lack of mobility infrastructure that communicates them with cities where they could sell their production. Even though one of the strategies of Producción para el Bienestar is giving credits for coffee production to small coffee producers, prioritizing indigenous ones, the strategy is focused only on production, and it is not ambitious enough: by 2020 it aimed to reach only 20 000 producers (Secretaría de Desarrollo Rural, 2020). On the other hand, relying only on the federal government's health, education, and social welfare programs, has proven to be insufficient to meet these communities' needs, according to experts' opinions (personal interviews, 2022). Social equity is far from being achieved when policies are still focusing on productivity and competitiveness as the main

approach to social development and poverty alleviation and when they allocate the majority of the subsidies in well-connected communities, such as peri-urban communities.

The adoption of normative coherence for sustainable development as a mechanism and antifragility as the means for Raworth's safe and just space is this dissertation's proposal of a new pathway to crisis response and sustainability. First developing a conceptual and analytical framework which was later operationalized, allowed me to assess the distance between what public policies and institutional frameworks promote at a regional level and the safe and just space in which coffee social-ecological systems, including the coffee-growing communities in them, can thrive and balance the need for social equity, economic development, and environmental conservation. The conceptual and analytical framework I have developed in this dissertation engages with several dimensions that policy coherence for sustainable development and the 2030 Agenda implementation. At the same time, I related the safe and just space model to the general risk equation (risk results from the interaction of vulnerability, exposure, and hazard) by adding the protection dimension to the safe and just space, as a way to reduce exposure to shocks.

Contributions of Normative Coherence and antifragility for the Safe and Just Space to sustainable development discussions

According to Breuer and colleagues, policy coherence is a systematic mechanism of promotion of policy actions that comprises institutional, geographical, temporal, and sectoral dimensions (Breuer et al., 2019). In their review article on SDGs interdependences and its translation into policy advice, these authors propose a road

map to translate academic knowledge on SDGs interdependences into coherent policymaking. These road maps can be summarized as follows: identifying the problem and situating it in the geographic or territorial context, identifying the input needed, the stakeholders involved (and their interests), and the risks that can potentially affect the output; analyzing the synergies and tradeoffs between the desired output and the other goals and targets; discuss the normative and ethical implications that can come from the synergies and tradeoffs and finally, develop policy recommendations for improvements in the area under research. In the following lines, I describe how the proposed approach: normative coherence and antifragility for a safe and just space engages with the four dimensions understood by Breuer et al. 2019. The first component of this qualitative analytical approach is policies' normative coherence for sustainable development. The analysis engages with the institutional dimension of policy coherence for two main reasons: the analyzed policies (State Development Plans) constitute institutional guidance for the sectoral policies in the state of Veracruz and the insertion of specific laws, programs, and policy reactions in wider institutional frameworks is addressed as well. The State Development Plans (PVDs for its initials in Spanish) are the central policies not only in Veracruz but in Mexico, given the political and government system of the country. They contain the main objectives designated for all the policy sectors: agriculture, infrastructure, health, environment, education, security, etc. This shows the main normative principles that are embraced, and together with the strategies and actions proposed, their level of commitment to the different categories of the safe and just space. I have built social equity, planetary boundaries, and protection. The interaction between each objective, strategy, and line of action (the PVDs normally include more than one per

each policy sector) and the afore-mentioned categories is assessed in terms of the degree of institutional commitments, the direction of the interaction (enhancing or hindering) and nature of it (intentional or unintentional) addressing the sectoral dimension of policy coherence. Similar to Niestroy et al. (2016) I have grouped the normative principles of the safe and just space in categories, following the logic of the indicators contended by Raworth (2017). Normative coherence analysis and antifragility analysis have been performed taking into account the context of the study: Veracruz's coffee production region's characteristics and vulnerabilities, the challenges that coffee growing communities face, and the historical crises of coffee social-ecological systems, accounting for the geographical dimension of policy coherence.

Normative coherence in two different moments concerning the coffee rust is assessed, before the major outbreak and after it. The lack of continuity of policies implemented in the past was repeatedly mentioned by most of the policymakers interviewed, constituting an obstacle to an adequate policy framework and the capability of thriving coffee social-ecological systems. Furthermore, the transformation of governmental institutions implied a change in values: a more integral view of development but not necessarily the change in the structures that will have allowed an adequate and coherent response to crisis and sustainability implementation. By still focusing efforts on productivity, and competitivity and by not targeting the most vulnerable segments of coffee growers, the implemented changes fall short of their intended outcomes: "to make the necessary effort to achieve a sustainable development" (Plan Veracruzano de Desarrollo, 2019, p.17).

In terms of the overall coherence of the PVDs, a decreased coherence for the safe and just space is noted. The score for the safe and just space and the glazed safe and just space was lower in the 2019-2024 PVD than the ones in the 2011-2016 PVD. This reinforces that despite there being an explicitly expressed intention to foster sustainable development, a lack of normative commitments hindered its accomplishment. Siloed policies have still been implemented where the focus on interlinkages and the indivisible nature of sustainability is not fully grasped by decision-makers: a need for further collaboration through institutionalized structures and spaces as well as citizens' participation is needed, as long as it is representative and legitimate. An absence of flexibility in decision-making processes, policy design, and policymakers' responses is one of the challenges remaining. Whereas dialogue is embraced in the policy texts as a collective knowledge-building strategy, dialogue between citizens (in this case coffee producers) and government officials is limited. The limited information and knowledge exchange in policy communities evidenced in the interviews belonging to these policy communities show how, a negative interaction between, for example, an agriculture objective and an environmental protection measure, is the result of poor governance. Added to centralized decision-making, and a bottom-down approach this counteracts sustainability and vulnerability reduction. An example of this is presented in chapter 5, in which producers participating in a government program, explain to a program group coordinator, the poor survival capacity and performance of a specific variety of a crop due to the local weather and soil conditions. Despite their efforts to communicate this to the regional heads of the program, their worries are ignored since the program has rigid rules to be followed (the mandatory crop is a native variety with a biocultural value that must

be protected and reproduced to ensure its survival). The aforementioned examples of poor governance are evidence of a lack of antifragile governance responses to crises. Whereas the government of Veracruz has made some progress in terms of establishing a road map to implement some of the 2030 Agenda, there are still several windows of opportunities: focus on the interlinkages, synergies, and tradeoffs between the goals targeted, develop a participative mechanism to widen the policy community involved and focus more on the most marginalized communities affected by the policies proposed.

Normative coherence and antifragility for a safe and just space constitute an innovative approach, it identifies the beneficial interactions between policies, policy sectors, and institutional frameworks. It provides a useful starting point for the members of policy communities (government, policy communities, and citizens) to rationalize sustainability targets and direct their efforts to target particular challenges identified in the pathway to a safe and just space. At the same time, this approach locates the gaps between the policies and political intentions as expressed in wide policy objectives, and the values and normative principles promoted. Finally, it contributes to the development of cross-sectoral collaboration by pointing at the sectors and policy arenas whose interactions are negative, in terms of sustainability.

Further research steps and recommendations

To understand to a greater extent the policy gaps and interactions in Veracruz's State that undermine the achievement of the Safe and Just Space, a vertical normative coherence analysis is recommended. This will assess how aligned the normative commitments established at the state and local levels are with the ones made at the

National level and how the policies at this level are coherent with the normative principles for the Safe and Just Space, which is a limitation of this study.

To engage more with coffee communities and contribute to the improvement of their living conditions, participative policy coherence will be highly useful to match their needs and framing the challenges they face with the knowledge coming from stakeholders outside their communities, such as academics and practitioners that can build with them, solutions based on their expertise and knowledge.

On the other hand, a Social Network Analysis of the policy communities of coffee in Veracruz will allow a better understanding of the decision-making processes and level of engagement of the stakeholders. A Social Network Analysis identifies the structural characteristics of the policy communities and contributes to a better integration of its actors in the policy cycle and hopefully improving policy coherence and sustainability in the coffee systems of Veracruz.

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