Integrating the four faces of climate change adaptation: Towards transformative change in Guatemalan coffee communities

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ABSTRACT

Despite the complexity of climate change, the dominant definition and practice of adaptation remains reactive, incremental, and focused primarily on biophysical and techno-managerial changes. Researchers suggest this is necessary but insufficient, noting the importance of integrating subjectivity in a more comprehensive approach to adaptation and in moving toward deliberate transformation in a climate change context. Here, I consider how to expand the scope and depth of 'adaptation' as it is currently defined and practiced, presenting an Integral conceptual framework that integrates the 'interior' forms of adaptation and thus can account for the diverse ways that local people are responding to entangled changes at the local level. Drawing on case study research in Guatemala, I explore how a more balanced integration of subjective and objective adaptive capacities, in individuals and collectives, leads to four types of adaptation—personal, practical, critical-structural, and co-generative. Findings describe: 1) how critical-structural adaptations were helpful in disrupting structural arrangements in ways that practical adaptations alone were not; and 2) that the interior adaptations (personal and co-generative) were less emphasized overall but can be effectively integrated, either implicitly or explicitly, with dominant forms of adaptation practice. This study demonstrates how a more comprehensive approach to adaptation may better position communities to engage in transformative change.

1. Introduction

Of all the oppositions that artificially divide social science, the most fundamental, and the most ruinous, is the one that is set up between subjectivism and objectivism. The very fact that the division constantly reappears in virtually the same form would suffice to indicate that the modes of knowledge which it distinguishes are equally indispensable to a science of the social world that cannot be reduced either to a social phenomenology or to a social physics. (Bourdieu, 1992, p. 25).

Climate change adaptation, defined and practiced in a primarily technical manner, has been called "necessary, but not sufficient" (Pelling, 2011, p. 6), as it is mismatched with the actual complexity of the climate change issue (O'Brien, 2018). Ensor et al. (2019, p. 228) have described mainstream adaptation practice as not asking the right questions, which in turn shapes the definition and practice of adaptation towards technical adjustments, rather than recognizing the more complex entanglements of social, cultural, economic, political, and biophysical change. This can perpetuate business-as-usual development logics and structures that reinforce technocratic patterns of control, and fail to meet the dynamic intricacies of the climate change issue (Scoville-Simonds et al., 2020). O'Brien (2012, p. 673) emphasizes the need to gain a "deeper understanding of the human dimensions in order to inform transformative responses to complex problems such as climate change." As researchers seek this deeper understanding and conceive of what might be more commensurate with such complexity—subjective human dimensions—or what I refer to here as 'interiority,' is receiving increased attention in debates about global environmental change processes (Manuel-Navarrete et al., 2019). Interiority refers to the intangible, unseen domain of life in both the individual and collective spheres, including beliefs, understanding, morality, motivations, values, and worldviews (O'Brien & Hochachka, 2010). Gosnell et al. (2019, p. 1) describe how climate-smart adaptation, for example, involves more than technological innovation; rather, "it involves subjective, nonmaterial factors associated with culture, values, ethics, identity, and emotion." Pointing out the importance of interiority as well as its gap in mainstream adaptation, these scholars argue that alternative epistemological starting points for adaptation research and practice are essential for building more effective responses (Ensor et al., 2019; Nightingale, 2016; O'Brien & Hochachka, 2010), and some researchers go as far as to redefine sustainability as being contingent on the "congruence

between subjective and objective dynamics." (Manuel-Navarrete, 2015, p. 1).

Yet, the subjective, interior dimension of climate change is the least well-represented in current adaptation efforts and it is not equally weighted with the other strategies (O'Brien & Hochachka, 2010; Wamsler & Brink, 2018; Woiwode, 2016). Climate change funding continues to privilege the natural and technical sciences over the social sciences by an enormous degree; as such, many of the key unsolved climate-change puzzles are in the realm of the social sciences and involve interiority, not the least of which include how the rapid and deep alteration of attitudes, norms, incentives, and politics called for across the climate change field might in fact occur (Overland & Sovacool, 2020). O'Brien (2018, p. 155) notes that "the objective and subjective dimensions...have been widely described in the literature on climate change responses, yet seldom integrated." Despite studies on the psychological dimensions of adaptation (Grothmann & Patt, 2005), on how to account for "emancipatory subjectivities" (Manuel-Navarrete & Pelling, 2015, p. 558), on the relationship between "human beings' inner dimensions and adaptation" (Wamsler & Brink, 2018, p. 55), on the role of "interiority" in climate change adaptation (O'Brien & Hochachka, 2010, p. 92), or on involving the subjective, non-material factors (Gosnell et al., 2019), further research is needed for how to meaningfully and rigorously *integrate* this understanding of interiority in climate change responses. Better integration of the subjective and objective dimensions of adaptation, in individuals and collectives, may provide a way for adaptation to be more deeply rooted than technical changes, and adequately address the structural and psychological aspects. When understood as more than an objective application in a region, adaptation becomes a process that is understood and experienced subjectively and worked out inter-subjectively amongst people.

Here, I explore the integration of these interior dimensions for a broader and deeper approach to adaptation, further iterating O'Brien and Hochachka's (2010) preliminary ideas for an Integral adaptation framework and taking the Bourdieu (1992) quote above seriously. Since the research gap is not in the *absence* of this scholarship on interiority per se, but rather in its integration into the overall field, I proceed with optimism that such integration may open up new potential for how to engage adaptation from an alternative epistemological starting point and in a transformative manner. This optimism derives from studies that suggest that some of the most powerful leverage points for systems change are actually interior, such as paradigms and worldviews (Abson et al., 2017; Meadows, 1997; O'Brien, 2016), and that the probabilities for transformation become generated as these exterior and interior dimensions are integrated in a more balanced manner (Esbjorn-Hargens & Zimmerman, 2009; O'Brien & Hochachka, 2010; Riddell, 2013). Throughout this paper, I explain the details and dynamics of what I mean by this in adaptation. For now, my point here is that important work ahead, particularly for adaptation practitioners, policy-makers, and researchers, may be to draw together and synthesize the subjective and objective perspectives that already exist in adaptation in novel ways, which may reveal unseen potentials or help to sharpen understanding of existing puzzles in climate change adaptation practice.

2. Background

2.1. Where the story begins

Climate change impacts are pronounced for coffee. Studies project that Arabica coffee (*Coffea arabica* L.)—70% of global production—is considered a climate-sensitive species, facing severe risks and projections with global warming (Davis et al., 2012), which is anticipated to exacerbate other stressors that producing regions face. Guatemala, for example, has the highest proportion of ecologically degraded land in Central America (currently 58.9% of the nation) (Magrin et al., 2014, p. 1514), is the most food insecure country in the region (affecting one third of population), experiences high rates of migration, and has the greatest impacts of climate variability and change in the region, all of which coincide in the coffee sector. The warming temperatures, associated increases in pests and plant diseases, and climatic variability present a complex challenge to an already socio-economically stressed rural population.

Producers are doing everything they can on their farms, largely with what is considered techno-managerial adaptation. Despite this, the problem seems to morph and shift swiftly, with unexpected challenges arising each year, leaving many to question whether technical adjustments are sufficient to address such a multifaceted issue. Constraining adaptation to primarily objective efforts (i.e. applying fungicides, retaining soil moisture, new seed varieties) reduces the full complexity at hand. Integrating subjective dimensions (i.e. beliefs, values, meaning-making, etc.) with those ongoing objective efforts may be crucial to be able to see the entire range of adaptative responses and, when taken together, may be able to reckon with the interlocking root causes of the issue.

2.2. Including the objectivity and subjectivity of adaptation

Technical approaches to complex issues are seldom enough, and research in climate change adaptation is increasingly critical of their limited scope and inability to address the structural aspects underlying the climate challenge. There are calls to rectify that situation, not only by taking a more critical approach (Pelling, 2011; Scoville-Simonds et al., 2020; Sherman et al., 2016), but also by coupling material and cognitive dynamics and integrating these subjective or interior dimensions more effectively (Gosnell et al., 2019; Manuel-Navarrete, 2015; O'Brien, 2018).

Albeit somewhat eclipsed by the dominant techno-managerial adaptation definition, literature on the interior dimensions of adaptation exists. There has been substantive work on the interior dimensions of environmental experience in the social sciences (Breakwell, 2010; Gifford, 2011; Markowitz et al., 2013; Weber, 2010), some of which preceded climate change scholarship. Among the forerunners was White (1945) who studied human adjustment to environmental change 75 years ago, including human perception, aspirations, and understanding, as part of what became known as a "wisdom tradition" in geography (Wescoat, 2006, p. 707). However, the issue of climate change presents a unique set of challenges today—with its scale, dynamism, and the fact that it is an "evolving construct" (Breakwell, 2010, p. 857)—requiring an adaptation that can coevolve with it, not as an external threat to be adjusted to or managed but as an internal aspect of our decisions, choices, and even values (Pelling, 2011). There remains a need "to develop and test frameworks that facilitate a systematic examination of the subjective attributes of climate change adaptation" (Fresque-Baxter & Armitage, 2012, p. 251) and to consider the connections between perception/awareness and behaviour change in adaptation (Gosnell et al., 2019), in both individual and collective domains.

To better understand the role that individuals' subjectivities play in adaptation, Grothmann and Patt (2005) developed a Model of Private Proactive Adaptation to Climate Change (MPPACC), which was later built upon by Frank, et al (2011). In these studies, the distinction was made between "objective adaptive capacity," what an individual could *do* as indicated by the availability and access to resources, and the "subjective adaptive capacity," which is their *perceived* ability to carry it out, or the extent to which they

felt they have control over global and regional environmental problems (Grothmann & Patt, 2005). These perceptions of agency when facing intractable issues and the ways in which individuals subjectively enact resilience are forms of personal adaptation.

In the collective domain, research has been done on the inter-subjective dimension of adaptation as well. Manuel-Navarrete et al. (2019, p. 2) view "collective intentionality as a key subjective force in the Anthropocene." Adger and Kelly (1999, p. 257) describe how "adaptation is socially mediated…as a composite of individual adaptation, such that adaptation comes about through activities which depend on the participation of group members in discourse, imitation, or shared collective or individual action." While many of the unpredictable variabilities in weather compound pre-existing inequalities and social stressors, nevertheless "there is reason to believe that positive consequences are also possible, as people take collective responsibility for a shared problem" (Swim et al., 2009, p. 8). Tschakert et al. (2016) describe how this requires collective learning spaces and ways to build emancipatory agency together, including "tools, processes, and practices that support the generation and exchange of knowledge and facilitate decision making" (p. 182). Scaling this more broadly, Manuel-Navarrete et al. (2019) describe how collective intentionality is a necessary force to disrupt unsustainable path dependencies.

What these researchers argue is that *objective* adaptive capacity—such as resources, affluence and socio-economic factors that predominate in mainstream adaptation studies is—important; however, the *subjective* and *inter-subjective* adaptive capacities in a region may actually be equal or even more important areas to focus on (Gifford, 2011; Grothmann & Patt, 2005). In response to

this argument, an increasingly number of studies have, for example, sought to understand the role of beliefs, values, and world-views in transforming individual and shared mindsets (O'Brien & Sygna, 2013), the emotional implications of climate change and for reconceiving "low-carbon subjectivities" (Head, 2016), the process of "subjectivization" in perpetuating path dependency (Manuel-Navarrete et al., 2019), the cognitive and psychological processes that underlie public opinions (Wolf & Moser, 2011), and the plasticity of meanings and range of worldviews on climate change that factor into adaptation decision-making (De Witt et al., 2016; Hochachka, 2019; Hulme, 2009).

More work is needed to bring that area of scholarship forward, ensuring it is more equally weighted, and integrating "inner/subjective dimensions" in adaptation (Brink & Wamsler, 2019, p. 1351) in both individual and collective forms. Yet, there has been a noted "absence of a common interdisciplinary framework for organizing and linking subjective and objective research" (Thomas et al., 2018, p. 8) including that found in climate adaptation. This is the gap I address in this paper.

3. Towards an Integral framework for adaptation

In seeking a more integrative framework, I found that some calls for more 'holistic' responses to climate change carried an impractical sense of needing to include *everything*. Thomas et al. (2018) suggest this is particularly the case when the boundaries on what ought to be included are not clear and the measures to determine what is most significant are absent; they argue that rather than attempting to include multiple *disciplines*, it is prefer-
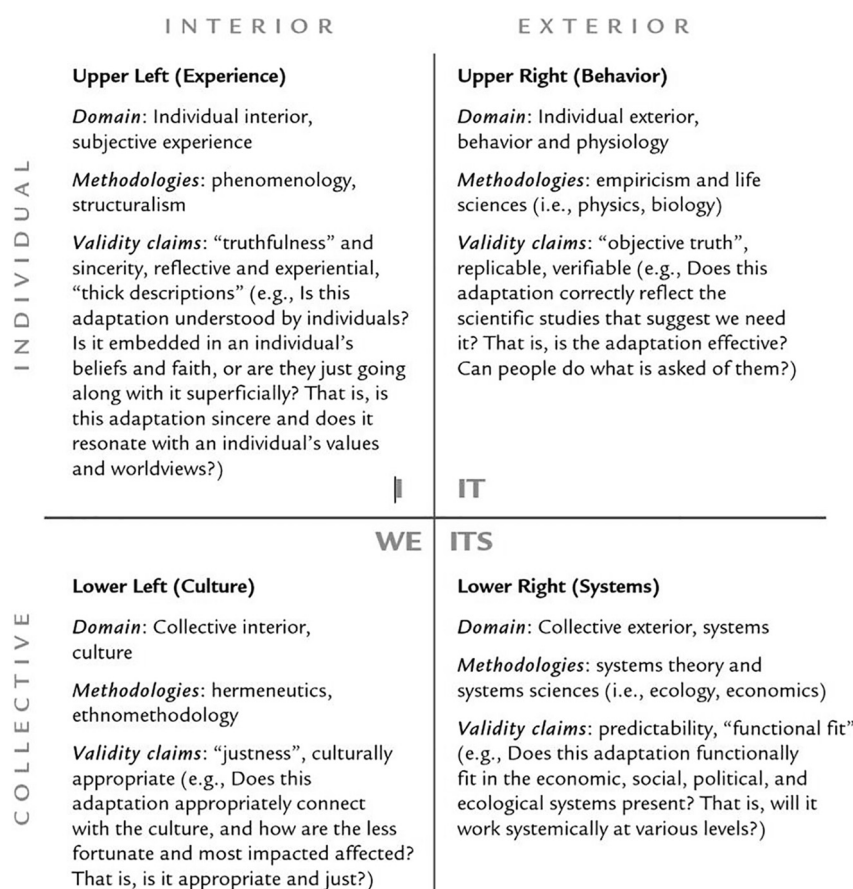
INTERIOR / **EXTERIOR**

INDIVIDUAL

Upper Left (Experience)

Domain: Individual interior, subjective experience

Methodologies: phenomenology, structuralism

Validity claims: "truthfulness" and sincerity, reflective and experiential, "thick descriptions" (e.g., Is this adaptation understood by individuals? Is it embedded in an individual's beliefs and faith, or are they just going along with it superficially? That is, is this adaptation sincere and does it resonate with an individual's values and worldviews?)

I | **IT**

Upper Right (Behavior)

Domain: Individual exterior, behavior and physiology

Methodologies: empiricism and life sciences (i.e., physics, biology)

Validity claims: "objective truth", replicable, verifiable (e.g., Does this adaptation correctly reflect the scientific studies that suggest we need it? That is, is the adaptation effective? Can people do what is asked of them?)

WE | **ITS**

COLLECTIVE

Lower Left (Culture)

Domain: Collective interior, culture

Methodologies: hermeneutics, ethnomethodology

Validity claims: "justness", culturally appropriate (e.g., Does this adaptation appropriately connect with the culture, and how are the less fortunate and most impacted affected? That is, is it appropriate and just?)

Lower Right (Systems)

Domain: Collective exterior, systems

Methodologies: systems theory and systems sciences (i.e., ecology, economics)

Validity claims: predictability, "functional fit" (e.g., Does this adaptation functionally fit in the economic, social, political, and ecological systems present? That is, will it work systemically at various levels?)

Fig. 1. The Integral framework's four domains of reality, with validity claims related to adaptation (adapted with permission from O'Brien and Hochachka (2010, p. 93)). This approach has also been applied to sustainability (Brown, 2006; Riddell, 2013), ecology (Esbjorn-Hargens & Zimmerman, 2009), and climate change (Esbjörn-Hargens, 2010); Morgan et al., 2012; (Riedy, 2008)).

able to include multiple *perspectives*. I found that the quadrants of the Integral framework were useful in this respect. By combining first-person perspective and third-person perspective (individual and plural), these quadrants disclose four domains of reality: experience, behaviour, culture and systems (Fig. 1). This has been theorized by Wilber (1996), applied in ecology and sustainability (Brown, 2006; Esbjorn-Hargens & Zimmerman, 2009), and applied in a preliminary manner to climate change adaptation by O'Brien and Hochachka (2010) and Morgan et al. (2012).

In Fig. 2, I posit that climate change adaptation has four irreducible expressions or faces, made up by the interior or exterior dimensions of individuals and collectives. The interior dimensions are considered subjective and inter-subjective aspects of individuals and collectives, respectively. The hypothesis is *that deliberate inclusion of more quadrants and perspectives (be it implicitly or explicitly) would lead to a more comprehensive adaptation—possibly even rendering an alchemical emergent* (which is further explained in point 3 below). If true, it would support climate change policy-makers and practitioners in expanding the concept of adaptation to include all four of these aspects that are important to people in responding to change and may also shift the focus away from treating climate change as a technical problem to that of an adaptive challenge.

The Integral adaptation framework includes certain propositions; the following four are relevant to this study:

1. First, the quadrants are implicit and inherent to people's experience. When deliberate attention or intention is brought to bear on the processes or practices in these dimensions of experience, these four quadrant-domains could be described as being 'more balanced.' For example, every individual coffee producer has a subjective, interior dimension (Upper-Left quadrant), but not everyone deliberately includes interior, *personal*

adaptation processes as they go about coffee production. Or, every group of coffee producers has inter-objective ways in which they functionally-fit within other systems in a region (Lower-Right quadrant), but not every group intentionally includes a deliberate *critical-structural adaptation* for how they participate in those systems.

2. It has been proposed elsewhere that this greater balance may produce wellbeing or 'inherent health in the all-quadrant occasion' (be it, in a cooperative, family, community, or individual), and vice versa (i.e. a deficiency in one area can stall progress in others) (Esbjorn-Hargens and Zimmerman, 2009). Therefore, while gaps are not necessarily problematic, they ought to be examined carefully, as they may indicate an imbalance of focus or that an important aspect of comprehensive adaptation has been missed, and synergies warrant close study to see how elements came together, why, and with what effect. If this framework is applied explicitly, it would be possible to design adaptation policies and programming with a deliberately broader, deeper scope, carried out individually (i.e. by a farmer or by a policy-maker) or in a group (i.e. by a cooperative executive committee or by an NGO board of directors).

3. Integration happens through including the first- and third-person perspectives of individuals and collectives, thereby creating the conditions for adaptation in personal, practical, co-generative, and critical-structural forms. Engaging these four expressions of adaptation in a deliberately more balanced way—whether that is done implicitly by engaging processes in these inherent aspects of experience or explicitly by applying such a framework as this—opens up different framings of the problems and different types of solutions, and could affect some type of 'alchemy,' in which a whole emerges that is greater than the sum of the parts. This could include transformation, defined here as a "significant change in form, structure and/or meaning-

	Interior	Exterior
Individual	**Personal adaptation** Personal competencies such as attitude, values, self-regulation, resilience, or metacognitive skills, that support individuals in how they orient psychologically to meet the adaptive challenge. *Subjective perspective* - *Occurs as* individuals build or maintain personal wellbeing, resilience or anti-fragility in order to stay well in the face of ongoing, unexpected, entangled impacts of climate change. - *Includes* the personal processes used to be whole and well, resilient (bouncing back into shape) or antifragile (bouncing forwards into greater wellbeing); to become aware of the situation one is in; to draw on insight and intelligence from within.	**Practical adaptation** Technical or behavioural competencies to bounce back, diversify, shift practices flexibly, be practically resilient to impacts, or dynamically prepare for what might come. *Objective perspective* - *Occurs as* individuals apply new skills, practices or technologies in order to stay well in the face of ongoing, unexpected, entangled impacts of climate change. - *Includes* the behavioural changes and technical efforts taken towards adaptation; includes managerial or technocratic solutions; can be 'innovative' when working on longer time-lines.
Collective	**Co-generative adaptation:** Inter-subjective or inter-personal competencies for adaptation, such as social capital, networking capacity, or collective processes working together on complex problems, in order to stay well specifically towards climate change. *Inter-subjective perspective* - *Occurs as* groups maintain their collective wellbeing, resilience or anti-fragility, collectively problematizing an issue, building social awareness, and for developing a shared vision towards adaptation. - *Includes* the inter-subjective capacity to react, problematize and vision collectively, to maintain social resilience or develop antifragility.	**Critical-structural adaptation:** Systems competencies to challenge, contest, reflect on, advocate for, or create the systems and structures needed to support adaptation in a way that also considers the overall developmental trajectory and the deeper interlocking causes of climate change. *Inter-objective perspective* - *Occurs as* groups address the structural and systemic dimensions underpinning the impacts they are experiencing, to address the aspects needed to stay well in the face of change. - *Includes* the inter-objective competencies used to contest existing systems and re-create new ones that are more adequate to the task of ensuring sustainable livelihoods in a changing climate.

Fig. 2. The four faces of adaptation (Brown, 2006; Esbjorn-Hargens & Zimmerman, 2009; Morgan et al., 2012; O'Brien & Hochachka, 2010; Wilber, 1996).

making" (Leichenko & O'Brien, 2019, p. 180), and may contribute to the understanding of how fundamental, step-changes of the sort proposed by 'transformational adaptation,' as compared to 'incremental adaptation' (Kates et al., 2012; Few et al., 2017), may come about. O'Brien and Hochachka (2010) even suggest that adaptation may require active engagement with, and changes in, worldviews, belief systems, and values, which they suggest occurs through this deliberate integration of interiority.

4. However, questions remain in the literature regarding the pathway from comprehensive adaptation to transformation. Some scholars suggest is not necessarily linear, but rather is *enactive*, which means brought forth or disclosed by a series of behaviors of a perceiving subject or subjects (Di Paolo et al., 2010; (Esbjörn-Hargens, 2010); Wilber, 2006). The proposition here is that *a well-rounded adaptation may increase the probability of transformation being enacted.* This paper engages this in an exploratory manner, but is not explanatory and does not undertake a rigorous test for whether transformation had occurred, which, albeit an important future question, would not only require more space and a different design, but is also a contested subject (Salomaa & Juhola, 2020). Rather, I attempt to connect the ideal of transformation with the practice of adaptation, through an emphasis on the meaningful integration of its four faces, which O'Brien and Hochachka (2010, p. 100) proposed:

can foster radical transformations in the way that we think about responding to change, from something that society manages through behavioral and systems changes to something that humans consciously create in alignment with their beliefs, values, and worldviews.

To the extent possible, I reflect on the evidence of transformation using the above definition and this quote as indicators.

4. Case study of adapting to climate change in coffee growing regions of Guatemala

4.1. Research design

Are these four faces of adaptation present in how people navigate complex change processes due to climate change, and if so, how are they relevant? What insight could be gained from this for possible application in other unstudied regions?

To study these research questions, I carried out qualitative case study research in the coffee-growing region of Guatemala. Three trips were conducted from 2017 to 2019, for which ethics approval had been granted by the Norwegian Center for Research Data. I used an abductive research approach (Dubois & Gadde, 2002), which entails iteratively moving between inductive, open-ended research to "soak and poke" in the details of the case and casting my net widely for alternative explanations to more deductive attempts to verify hypotheses (Bennett & Checkel, 2015, p. 18).

I structured this research as a pathway case study (Nome, 2007) which "aimed to gain insight into the mechanisms that connect some explanatory variable (X1) to some outcome (Y) in specific cases," (Weller & Barnes, 2016, p. 430) from which insights could then be used in other case sites that feature a similar X1/Y relationship. The outcome I was interested in was the approach to adaptation being taken. I selected these cases based on an expected relationship between X1 and Y (coffee-growing regions facing some degree of challenge due to climate change),

yet chose two case study sites that contained sufficient variation so to gain a perspective on the findings (Box 1). The two cases shared certain core similarities (both being coffee growing regions in the same nation and selling to the same buyer within the same value chain (X2 variables); yet, these cases could be considered 'most diverse' (Seawright & Gerring, 2008) as they also contained a lot of variation due to their spatial, historical and ontological differences (X1 variables, described further below).

Box 1. Independent Variables		SPN	MATA
X1 explanatory	q Spatial – highlands, distant from urban center, small producers, higher vulnerability	√	
	r Historical – civil war, cooperativist, critical-awareness / liberation theology	√	
	s Ontological – indigenous Mam, spirituality integrated (traditional or integrative worldview), gender influence (predominantly women)	√	
	t Spatial – dry corridor, close to urban center, larger prodcuers, more privilege and wealth		√
	u Historical – less war and more stability and privilege, individualist, higher technology		√
	v Ontological – Ladino, modern worldview, gender influence (predominantly men)		√
X2 controls	A Coffee production at over 1700 ft above sea level	√	√
	B Long histories of coffee production	√	√
	C Same primary buyer in global value chain	√	√
	D Same global value chain	√	√
SPN: q r s ABCD = Y (or, X1[qrs] X2[ABCD] = Y)			
MATA: t u v ABCD = Y (or, X1[tuv] X2[ABCD = Y)			

The design entailed careful use of evidence in a two-step study: first, to examine the main and rival hypotheses, by applying heuristic Bayesian reasoning (rather than the full mathematical apparatus of Bayesian analysis) to 'mentally inhabit the world' of each hypothesis and assess which one makes the evidence more plausible (Fairfield & Charman, 2020, pp. 15–16) (see Appendix 1); then, to consider the pathways to these different outcomes and what insights could be drawn from their differences (Fairfield, 2013; George & Bennett, 2005).

4.2. Background to case study sites

Both cases are located approximately 1700 feet above sea level (Fig. 3) and have long histories of *Arabica* coffee production as a main income-generating activity. Spatial, historical, and ontological differences exist in the two regions (Box 2), which become important in understanding their approaches to adaptation.
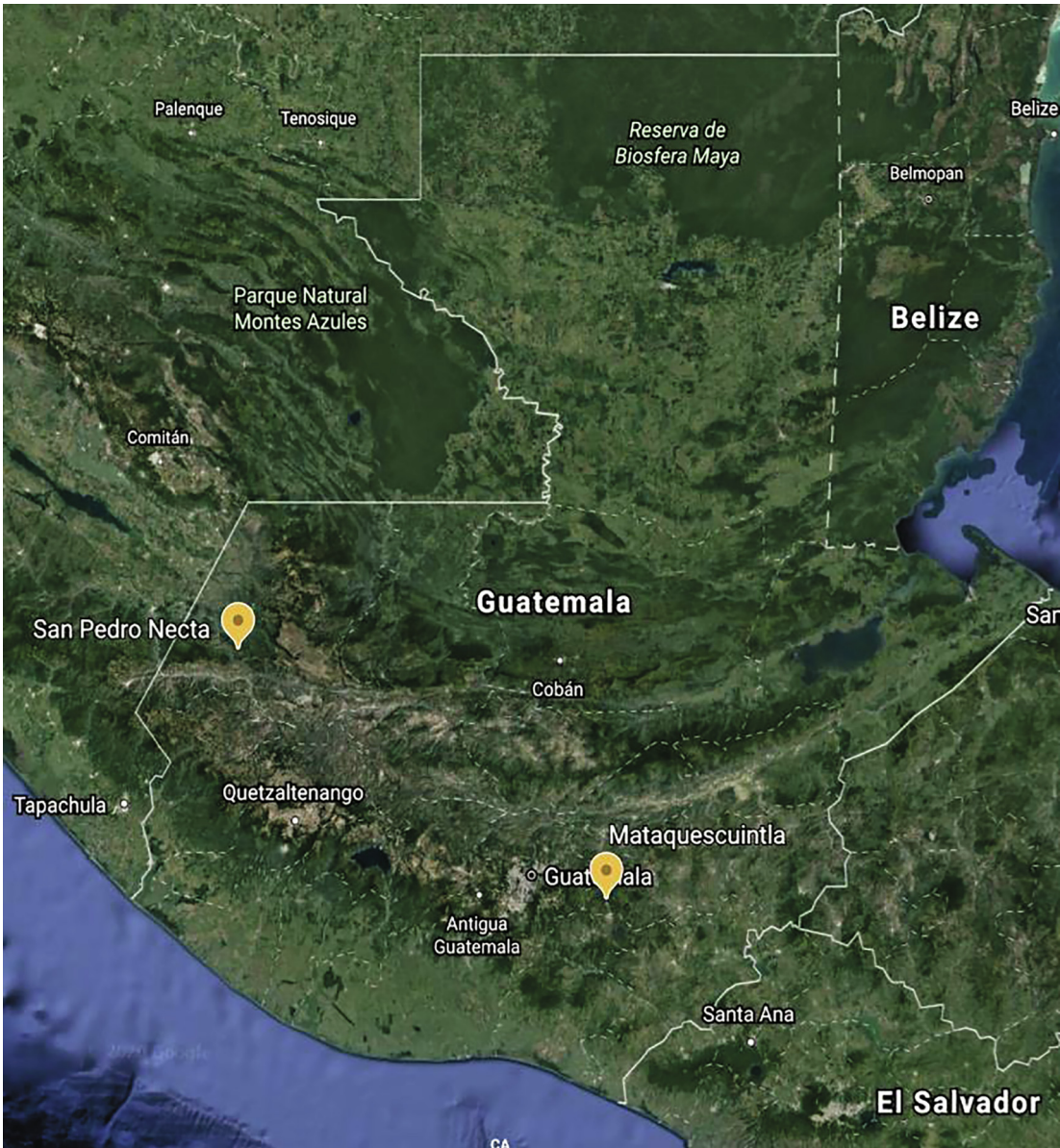
Fig. 3. Map of research sites in Guatemala.

Mataquescuintla (population 41,818)	*San Pedro Necta* (population 38,510)
Jalapa Department, 2.5 hours from the capital	Huehuetenango Department over 9 hours from the capital
Dry Corridor ecosystem	Western Highland ecosystem
Largely non-indigenous Ladino population (98.7% of total inhabitants)	Largely indigenous Mam population (82% of the total population)
Medium- to large-scale coffee producers.	*Small-scale* coffee producers

Spatially, economic potential is higher in areas closer to the capital city, in regions with favorable soil and road conditions, such as found in Jalapa; whereas the highland region of Huehuetenango is in a lower-per capita income bracket (World Bank, 2004, p. 33) and is more vulnerable socio-economically, consisting of smaller landholders, less infrastructure, difficult topography, and limited access to credit and financial capital (Cox et al., 2009; World Bank, 2004). These regions "tend to have lower levels of education, larger families, and strong communal traditions and cultural values that are not well understood in the context of the market economy" (World Bank, 2004, p. 3). Mataquescuintla, in the Dry Corridor, has more negative impacts attributable to climate change compared to SPN, in the more humid highlands, although SPN could be considered to be more vulnerable to those impacts having higher per capita poverty.

Historically, Huehuetenango was heavily affected by the Guatemalan Civil War (1960–1996), with much of the armed conflict being directed towards the indigenous Mayan populations. It had strong Leftist resistance and a prominent Catholic liberation theology influence during the war, and since that time, a preference for cooperative organizing (Jonas, 1991). In contrast, Jalapa in the southeast experienced less armed conflict and, being located so close to the city, a higher overall per-capita income, better roads, and more consistent markets, as well as larger farms and more

options to diversify production (Cox et al., 2009). Although Mataquescuintla's demographic characteristics made that region more privileged than SPN, on the other hand, the latter had had to reckon with, and build social networks for, persistent social, economic, and political hardships for many decades.

These regions have different worldviews, cultures, and religious affiliations, which create differences epistemologically (i.e. ways of thinking) and ontologically (i.e. in terms of the nature and relations of being) (Escobar, 2020), and which elsewhere has been found to influence adaptive capacity (Paerregaard, 2013; Pyhälä et al., 2016; Scoville-Simonds, 2018). SPN demonstrated a more *collectivist* culture, perhaps due to the exposure to Leftist-thought, which was resonant with and supported by both the Catholic social programs during and after the civil war as well as from the indigenous Mam influence. Both the Catholic Church and the Mam indigeneity—which are substantially woven together in the region as evidenced, for example, in the Mam practice of burning candles in the Catholic churches and praying the rosary on certain important Mam occasions—were heavily undermined and dismantled for political reasons during the civil war, by both the military as well as factions in the Evangelical church (Cobos García, 2006). However, aspects of the Mam cosmology are seen in the town and surrounding rural area (e.g. medicinal plants and ritual materials sold in the market suggesting the Mayan healing practices continued, women wearing traditional dress and continuing to practice Mam traditional weaving) and in some households (e.g. use of a Mayan wood-fired sauna), such that I could reasonably suspect that aspects of the worldview remained. For example, I noted a palpable openness to subjective experience in SPN, the latter demonstrated in the practice of prayer integrated into the course of daily life and organizational operations, suggesting possible influences from an *indigenous* cosmology, in which self (subjectivity) and nature/-world are not ontologically separate (Escobar, 2020).

Mataquescuintla demonstrated a more *individualist* culture, demonstrated by the individually-run farms and higher usage of innovative technology (e.g. sophisticated nurseries and irrigation systems). The population being almost entirely Ladino gave it a Western feel. While there was some Catholic religious affiliation, this was less evidently an integrated part of social life (e.g. prayers not included prior to meetings) and the mode of expression of people I spoke with was logical and rational. Although the lower levels of education were similar in both regions, people in Mataquescuintla had higher secondary and post-secondary education than those in SPN: 20% more secondary and 25% more post-secondary education (Instituto Nacional de Estadistica Guatemala, 2018). The values for freedom, progress, and achievement was suggestive of a *modern* worldview, defined by Leichenko and O'Brien (2019, p. 59) as that which "stress[es] individuality and the importance of rational inquiry…[and] trust in technological progress."

4.3. Methods, validity and analysis

My sample included 28 interviewees in both regions (15 in Mataquescuintla, 13 in SPN). This began through snowball sampling, but later was more purposive. For example, in Mataquescuintla I sought to interview a woman and sought a meeting with the Colisena cooperative as male producers and individual farmers predominated the sample up to that point. I did the same in SPN, but typically in reverse (i.e. male interviewees, unassociated farmers). In this way, I sought to ensure my sample was adequately representative of the coffee producers in both regions, despite the possibility of some intra-region variation.

The coffee producers I met with in Mataquescuintla (13 men, 2 women) were middle- to large-scale producers on farms that ranged from medium (50–100 manzana, 1 manzana = 8353 square meters or 2.064 acres) to large (upwards of 300 manzana) with

the exception of two temporary workers and one permanent employee. In SPN, research participants (7 women, 6 men) were small producers, meaning they produced coffee in a family-run manner on less than 50 manzanas of land; some worked in administrative positions in the coffee cooperative. Their names and positions are anonymized.

Methods included key informant interviews, site visits, participant-observation, and focus groups, which were conducted in Spanish. The primary researcher (myself) and research assistants spoke Spanish. Although some of the respondents in SPN spoke Mam as their first language, they spoke Spanish in a professional setting. An associated aspect of this study, although not reported on here, was the use of photography linked with questions (i.e. photo voice) in the indigenous SPN, which provided Mam-speakers with a non-linguistic way to share their ideas. Although I do not include the data from photo voice in this cross-case comparison—because I had not used that data-collection method in Ladino Mataquescuintla—it did assist me in SPN on checking for internal validity on subjective topics in the interviews and focus groups.

The interviews were semi-structured and often accompanied by a site visit to the producers' farm, wet mill, or workplace; some were walking interviews. The themes of the interview protocol were: 1) the respondent's background and current practices in coffee production, 2) the climatic changes they had observed over time, and 3) their past, present, and imagined future responses to those changes. The second set of questions frequently led to responses about broader changes in the region, in which respondents shared their views the natural world and its changes, and their roles/responsibilities in such change. Sometimes I prompted the interviewee with follow-up questions, such as "*How do you feel about that?*", and I also included some 'blue sky' questions in the third set, such as "*Imagine into the future when you are a grandparent (or an elder), what would you advise your grandchildren (or younger people) about climate change?*", which has been found to be helpful in reframing an issue more broadly (Berger, 2014) and which I found helpful for eliciting personal (subjective and intersubjective) perspectives.

I conducted focus groups in each community. Two focus groups (n = 12) in Mataquescuintla were held with members of the Colisena cooperative (*Cooperative of Non-Federated Coffee Producers*); these were largely different respondents than I had interviewed. In SPN, I held three focus groups (n = 10) with the Asaspne cooperative (*Asociación de Agricultores El Esfuerzo de SPN*) with the same respondents that I had also interviewed. The questions that guided the focus groups pertained to what 'climate change' meant to coffee producers, what changes and impacts participants had observed in the region, what common themes participants identified with or could add to from other responses in the group, and how participants were adapting and responding to stressors and challenges. The focus groups included gentle prompts for people to reflect on deeper meanings and beliefs they held about certain things, such as nature, changes over time, and society (including gender).

The research design included multiple verification strategies (Maxwell, 2013). These included triangulation of both methods and sources (many respondents were consulted multiple times with different methods in various settings) so that I could ensure I had reached data-saturation on the topics of interest and check whether or not what I heard on one farm was relevant elsewhere. Given the nature of some of the subjective aspects that I was interested in, I also distributed my research trips across 1.5 years, involving an ethnographic-style immersion in the case study sites, thus building rapport and mutual trust. The abductive approach and the use of process-tracing helped me in exploring alternative hypotheses and counterfactuals. By limiting travel in 2020, the glo-

bal COVID-19 pandemic affected my ability to conduct member-checking of the interview transcripts. However, I sent specific quotes that appear below for participants to check, and then, as per Birt et al. (2016), synthesized the slight elaborations they had sent back to me with their original quotes. I also emailed both cooperatives a translated summary of this paper, including the Results section. The strengths of my methods include depth and richness, and a possible limitation is that of generalizability.

Qualitative data analysis included note-taking, transcribing, and coding the interviews and focus groups, both manually and using NVivo (Miles et al., 2014). I coded transcriptions for what the data sought to explain (interior/exterior, collective/individual forms of adaptation) (O'Brien & Hochachka, 2010), which pronouns were used by the interviewee to describe this phenomena (i.e. "I", "we" or "it/its") (Wilber, 1996), and what forms of knowing (perspectival, participatory, procedural or propositional) were demonstrated (Vervaeke, 2019), based on Figure 2 and further explained in Appendix 2.

5. Results

The results found that coffee producers in the two regions adapted to change in diverse ways, weighting their adaptations differently across the quadrants (Figure 4). Mataquescuintla stressed the primary importance of practical adaptation (73%), with some references made to the critical-structural adaptation (16%), and with fewer references made to the interior adaptations (8% and 3% respectively). SPN described a more even spread of adaptations, with the practical and critical-structural at 29% and 35% of total responses coded, and with the personal and co-generative adaptations at 20% and 16% respectively (or, combined, 36%).

Overall, it can be seen that the interior adaptations (personal and co-generative) were less emphasized over the exterior (practical and critical-structural). However, in SPN, their distribution was more balanced, even though the exterior adaptations remained twice that of the interior (with 36% Left-Hand quadrants and 64%

Right-Hand quadrants.) Below, I examine the differences between these two cases depicted in Figure 4, examining the forms of adaptation in each quadrant.

5.1. Practical adaptation

Practical adaptation was employed by coffee producers in both regions like the front-lines of defense against climate change impacts. The top four of these practical adaptations consisted of 1) adding inputs into the coffee, such as fungicides, fertilizers, and mulch; 2) managing the coffee farm well, through pruning back the coffee, retaining soil humidity, and maintaining the shade trees; 3) planting different varieties of coffee which were more resistant to leaf rust, and 4) diversifying income generation, which (if affordable) included new export crops, external training, and also included migration to secure livelihoods elsewhere.

Additional inputs to manage the impacts of climate change made up the majority of codes in this quadrant. Adding more fungicide, more frequently, was reported as effective to keep the *roya* from spreading, but the additional applications are expensive. In Mataquescuintla, it was explained that as soon as a producer finds a case of *roya*, they apply fungicide in a 25 m circle around that tree, and "this now makes up 65–70% of their costs for production," the most-costly part of the operation (Respondent Mata 20). Similarly, in SPN, one respondent explained, "One must apply fungicide so that the *roya* won't spread every 45 days" (Respondent SPN 32), which can mean applying fungicides 4–5 times per year rather than the typical 1–2 times.

The second area of practical adaptation was the overall management of the coffee farms which included proper pruning, maintaining shade trees, correct timing for harvesting berries, and collecting the waste-water from processing the beans. One producer in Mataquescuintla explained how they've "had to return to the traditional coffee cultivation: sustainable, more shade forest, and less intensive agriculture" (Respondent Mata 11). In SPN, some respondents described how they learned new techniques for managing the coffee farms through technical support from the Catholic
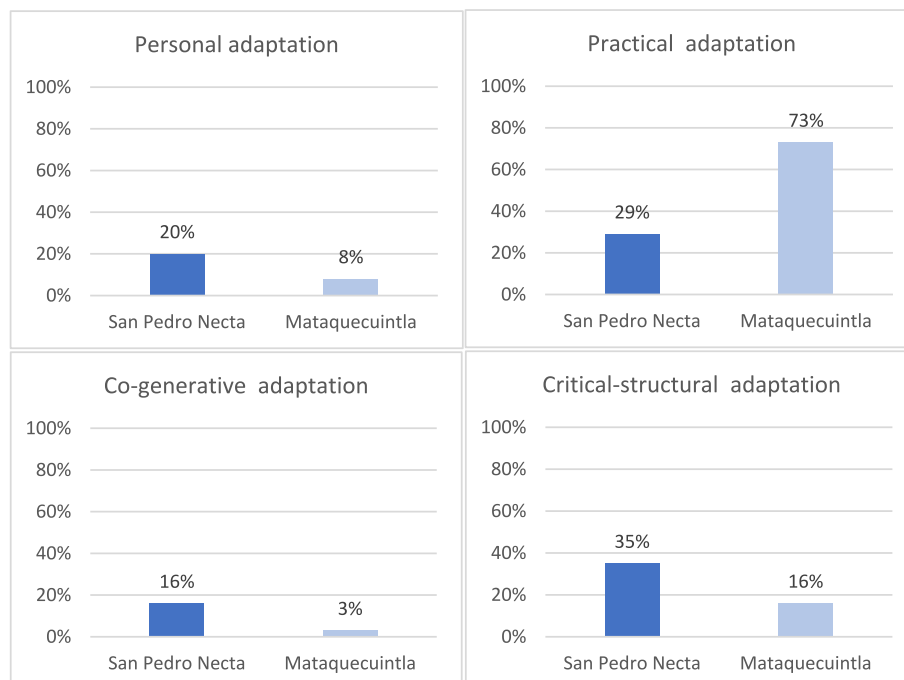

Fig. 4. Percent distribution of adaptations by quadrant (percentage of responses from interviews and focus group data were calculated based on the number of codes in each quadrant out of the total responses in each community. This mitigated for any quantitative difference in data collected in each community).

Church and from Anacafe (National Coffee Association), organized via the cooperative Asasapne: "Experts from the Catholic Church, helped us with technical support for the coffee plantations; I learned to sow along the contour lines so that the soil doesn't slip away [erode] and so that the water is retained" (Respondent SPN 27).

The third area of practical adaptation was the use of rust-resistant varieties to combat some of the climate-related impacts on the coffee. "A strategy that we've tried is to use new varieties of coffee plants in the coffee farms, some that are resistant to *roya*. We have analyzed this [across the farm] and 'renovated' the coffee trees that were susceptible to *roya*" (Respondent Mata 16). However, varieties that are resistant to *roya*, such as *Catimor* and *Sarchimor*, while they may be a stop-gap measure, were later found to not produce a quality cup and had to then be eliminated from the plantation. Explained one respondent in Mataquecuintla, "The truth is, we don't know what is coming next: we don't know what resistance we'll need [and] what varieties to sow" (Respondent Mata 24).

In Mataquecuintla, income diversification was a central adaptive strategy. For example, one respondent explained, "Another thing that can be done is to plant timber between the coffee plants, so that one is producing two things on the land" (Respondent Mata 13). The majority of producers I interviewed in Mataquescuintla had invested in a second or third industry on the coffee farm, such as poultry for sale to McDonald's, tomatoes for sale to Burger King, water to be sold in plastic bags locally, and timber. Other respondents there spoke about other diversification possibilities, such as Payment for Environmental Services, *Pin-For* program in which farmers were compensated financially by the state for maintaining their forests, or planting other income-generating trees, such as macadamia nut.

SPN did not use diversification as an adaptive strategy in the same way. Respondents explained that this was largely because they were small producers and part of the defining difference between small- and medium-sized production was precisely whether people had access to land and financial resources to diversify industrially into other products. One woman did small home-based income-generating businesses, such as, selling frozen chocolate bananas out of her kitchen and selling Avon products; however, it wasn't at the industrial scale of Mataquescuintla. The one producer in SPN who had diversified into tomatoes did so with money earned living in the USA for five years; during which time, he also raised funds to buy his property, the coffee trees for the farm, and to build his house. I heard about this type of USA-based savings strategy from at least two other coffee farmers as well as anecdotally from other people in SPN.

In both regions, migration was indeed a possible 'income diversification' strategy, sometimes to Mexico, more often to the USA; "Our parents cultivated coffee. I can cultivate coffee; I want the means to sell better—I don't want to have to go to the USA—but my son won't cultivate coffee if this business doesn't become sustainable" (Respondent Mata 23). In SPN, 7 out of 13 respondents had family members living in the North (which was not something I had asked formally in the interviews, but was mentioned as part of other answers). Explained one respondent in SPN, "Some men have already migrated to the U.S. and they send funds from there so that their wives can maintain the coffee plantations" (Respondent SPN 6). One producer in SPN had been given a development grant to employ 50 coffee workers to help reduce the drivers of US-migration.

5.2. Critical-structural adaptation

The majority of respondents in Mataquescuintla expressed frustration by their economic fragility in a global market and lack of voice in political-economic decision-making, both exacerbated by ongoing climate variability. A small minority of farmers, however, were fortunate to have secured a buyer who approached the coffee trade differently; as one respondent explained: "There are 'innovative people' who have differentiated themselves in the market, like 'James' (pseudonym), who have come to the field to do direct trade" (Respondent Mata 13). This innovative buyer bought at a price that was intentionally above the cost of production, invested in social programs in coffee communities, and sought to better understand the present and anticipated climate-realities in coffee-producing regions—and the arrangement demonstrated a small-scale case of critical-structural adaptation. However, these innovative practices did not necessarily add up to a restructured system of trade. Respondents noted the need for more such buyers like him:

> Do you know 10 more like James with that vision? with that deep conscience? James [who had first come here 27 years ago] had anticipated almost 30 years ago what we would like to see happening [here in this coffee growing region], I wish there were 1000 'James' in all of Guatemala (Respondent Mata 16).

Most of the respondents did not have access to this arrangement and instead sold into the general coffee market; some said they felt on the brink of giving up.

In this context, a group of producers in Mataquescuintla had amended the focus of the existing Colisena cooperative to be able to advocate for structural changes in the coffee sector, specifically for greater representation and equity for producers. "What we've tried to do is liberate a movement to support coffee workers" (Respondent, Mata 16). They further described how this advocacy for greater economic equality would support coffee producers in dealing with increasing costs and hardships due to climate change. This was an example of critical-structural adaptation.

In SPN, critical-structural adaptation was a key part of their response to change. The Asasapne cooperative was founded in 1989 to leverage greater equity for small producers in the coffee value chain.

> If we have fair-trade certification, we earn more from our product. And, for the small producer, [this gives us] many opportunities to look for more markets and training opportunities (Respondent SPN 22).

This also included mechanisms to secure financing, such as credit advances, donations, and grants, as well as other organizational supports for producers, some of which supported practical adaptation on the farm, such as, providing new coffee varieties, fertilizer kits, seedlings of shade tree species, or organic fertilizers. The cooperative also supports community resilience, including funding education and women's economic empowerment, and is involved in other global social movements, such as the Slow Food and Fair Trade Organic movements.

5.3. Co-generative adaptation

Co-generative adaptation was less present in the Mataquescuintla sample, but it was found to be important in SPN where respondents relayed a preference for collective organizing. They described how as a cooperative they learned, visioned and prayed together, problem-solved collectively, and supported each other mutually.

> Organization and unity are needed, to have strength, to have weight. Because if not, if you are only one, no... If there weren't others... No. There has to be others, so that when other organizations come along, it can be noted that you are associated, you are organized together. (Respondent SPN 27)

The way this was expressed made it seem like 'being organized' was a self-evident need, which in turn directly supported the other aspects of coffee production. This respondent went on to describe how "one feels that they are not alone, that they are associated like a family," and how this was particularly important in responding to climate change: "It is necessary that we all unite for this cause, so that together the fight against [there being no] pollution is greater" (Respondent SPN 27). This exhibited collectivist values, which may have had links with Mam cosmology or Leftist thought, and in some cases was referred to in a context of Catholic social programs, yet this was not explicitly framed as a political ideology or via Mam cosmology as such.

Other respondents described that among the top benefits of being with the cooperative was the capacity-building and shared learning that was available through it. That social capital was also drawn on to address other issues, whether those issues arose on the farm, in the market domain, or in the family unit. In relation to shared problem-solving processes, for example, one respondent described:

> We first talk about the difficult things people are each facing, each can express how they feel, later after speaking of all the negative things that we are feeling, we consider the Word of God. After that, we search for strategies, each one exposes what they feel they need, and after all that what we do is search for solutions that we know we can do to resolve this problem...and then put into practice each of those things. (Respondent SPN 6).

This prayer was pragmatic (integrated into meetings), was interchangeably Evangelical and Catholic, and seemed to provide a way to unify them to each other, with a higher purpose, and to their subsequent actions as a group.

5.4. Personal adaptation

Respondents also described how they individually stayed well in times of change, what I refer to as *personal adaptation*. This differed in kind and emphasis in the two case sites.

In Mataquescuintla, respondents noted this interior dimension inherent in their experience, but placed less emphasis on processes of personal adaptation as such. Some noted strong emotions, such as:

> frustration, sadness; because there is no incentive [to carry on], because one wants to give one's family [a] better [life], he wants to give them a better status, to bring them at least the basics (Respondent Mata 16).

Others carried personal attitudes or positive affirmations, such as "It is unsustainable to just cultivate coffee now; but *hope always lives*" (Respondent Mata 21, italics added). Others conveyed how their personal conviction was helpful as a source of confidence; as one man explained, "When I began the tomato nursery, my neighbours said, 'You are crazy to plant tomatoes in a green house!' But, in my sense of this, *pioneers are always crazy*" (Respondent Mata 11, italics added). Others described their faith as a support, such as one respondent explaining how he "called out to God in the middle of the coffee farm" (Respondent Mata 15) at the height of the leaf-rust crisis. These examples reflect the inherent interior dimension that was present for these farmers; however, these were not descriptions of processes for consciously working with their own interiority when faced with adversity per se.

In SPN, processes for personal adaptation were evident. Some respondents described how they reflected on whether their own actions were in alignment with their awareness. Others explained how they held a positive attitude of resilience in striving to overcome obstacles and personal convictions, including maintaining an "entrepreneurial spirit" (Respondent SPN 6), and others reported educating their children about their own potential to meet adversity. This suggested links between interior adaptive capacities and the ingenuity and tenacity needed for successful practical adaptation.

Some sought interior practices from within their religious-referents. Respondents recounted how their faith (Evangelical and Catholic religions) provided them a personal support through uncertainty and fear, making up a substantial set of codes for personal adaptation. This was to alleviate stress in hard times, to feel centered and calm, as well as a driver and stimulus for agency. One interviewee explained:

> The church alleviates stress. Because to go to church, one feels more relaxed when one returns home, things feel more beautiful. If you have problems and you go to the church, you leave your problems there, and then you return to your house with a different mentality, one of greater reflection about life (Respondent SPN 6).

These quotes spoke to the interior resilience gained through a practice of faith, but also the need for action:

> If we don't have love for God's creation, it is said we don't have love for God. I might say I am going to love and believe, I have faith in God, but if I am not taking care of what he has given, if I am not going to care for it, what is the use of praying? If I am not respecting God's creation, it is of no use to me [to pray]. It is of no use even though I am praying all day, but if I am not taking care [of my surroundings], I am not loving God. That's what I say... If we don't have love for God's creation, we don't have love for our neighbor and we don't take care of what God left behind, [but] if we love God, then we [must also] love Nature (Respondent SPN 2).

A respondent in Mataquecuintla also pointed out this need for more than just faith:

> [You may have] faith in God that the following winter may be better, but if [that isn't so] how do you get by? You are going to sell a part of the plot...but you are going to have to sell very cheap, because the other neighbor is doing the same! This starts a chain reaction, a domino effect, which realistically leads to poverty (Respondent Mata 16).

Both of these above quotes call for an integration of this personal dimension with that of the other quadrants—linking prayer with action, contemplation with agency—pointing to the integration of the interior and exterior responses to change.

6. Discussion

Here in this study, we find two cases—one, engaging these four faces of adaptation despite higher vulnerability to climate change and other stressors, and the other, privileged by technological and financial supports yet reaching the limits of a primarily practical adaptation in a context in which climate change gives rise to ongoing, unforeseen challenges. At the same time, interior dimensions of adaptation in individuals and groups may also reach such limits if they are not integrated with other exterior adaptive capacities. In this discussion, I consider the extent to which the four faces of adaptation are present and relevant to how people navigate complex change processes due to climate change, reflecting on the causal mechanisms in these pathway case studies and what insights might be drawn from them.

6.1. Benefits and bounds of practical adaptation, toward a critical-structural adaptation

The primary role of practical adaptation to climate change in both sites was notable (see Fig. 4), and yet limitations were also apparent. In Mataquescuintla, while it was the primary adaptation taken and aligned closely with the IPCC definition for adaptation—as "adjustments [made] in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities" (IPCC, 2014, p. 5)—the frustrations voiced by respondents underlined the futile nature of responding to climate change as a technical problem rather than an adaptive challenge (O'Brien & Selboe, 2015). Seen in the quotes by respondents in Mataquescuintla about how they never quite know what problem might arise next and the sense that coffee production teetered on the verge of unsustainability, the data suggest that the bounds of practical adaptation were largely due to it not being commensurate with the complexity and dynamism of climate change—while it helped to manage impacts, it alone was not changing trajectories.

The practical adaptation options for farmers in SPN were bounded by financial and technical limitations as small producers. Rural people there experienced greater migration from the region and greater vulnerability, yet had mechanisms for critically engaging with the developmental trajectory of the region. They were more inclined perhaps to see the "double-edged sword" of predominately practical adaptation measures: namely, that "although these measures may be important, they rarely address the wider and deeper systems and structures that are contributing to risk and vulnerability in the first place" (O'Brien & Selboe, 2015, p. 2). One respondent in SPN exclaimed, "well, one can't be a conformist about this!" (Respondent SPN 2), underlining how adaptation constrained to its practical dimension may inadvertently construe adaptation as *conforming* to climate change, without altering its root causes.

In summary, the benefits of practical adaptation are plenty, but its bounds exist for both pragmatic and ethical reasons. This is not a novel finding per se. However, the resolution to these limits of practical adaptation—suggested here as the integration of more of the other faces of adaptation—may be.

In both case study sites, coffee producers countered the boundaries of a practical adaptation with critical-structural adaptation. In Mataquescuintla, some farmers remained working individually but sought an 'innovative buyer' who had a critical-structural dimension to the company's purchasing policy (i.e., buying at a premium, investing in community development). Other farmers who had no access to that, felt frustrated at their limited capacity to affect systemic change, and so had joined the Colisena cooperative precisely to gain better political-economic leverage. In SPN, cooperative organizing had occurred many years ago, likely along with the rise of farm cooperatives in the indigenous highland region, which now provided a platform for the coffee producers to address climate change. Castillo and Nigh (1998, p. 144) describe how "part of [such a cooperatives'] success has been the ability to adapt competitively to the new 'reflexive economies' of the postmodern era", based less on faceless capital and more on solidarity and symbolic content (i.e. coffee from "the last descendants of the Mayans"). Asasapne has wrought a similar market share, which had connected them with a range of other buyers and with global movements to save native coffee varieties, promote the 'slow food' paradigm, and support organic, fair trade practices. Despite the fact that SPN exhibited characteristics of 'double exposure'—that is, exposure to both poverty and climate change (Leichenko & O'Brien, 2008)—the SPN coffee farmers had had to find ways to participate in disrupting the status-quo market dynamics and thereby were addressing some of the structural, root causes of both poverty

and climate change, beyond that of typical practical adaptation practice.

What is common to each of these examples of critical-structural adaptation is the exercising of inter-objective (third-person plural) critical perspectives towards adaptation—in other words, working together in a group of at least more than one, to somehow intervene in the system in which coffee production and sales were occurring. This corresponds with findings in other agricultural communities elsewhere, which had identified a need to move the adaptations carried out by farmers beyond the individual level and towards larger-scale, longer-term, linked-up approaches carried out with other actors (Manandhar et al., 2011), embedding power relations further up the chain of policy development (Nagoda & Nightingale, 2017).

6.2. Transcending the subject-object divide: Integrating co-generative and personal adaptations

Interior adaptations were proportionally less represented than the exterior adaptations in both regions, yet they nevertheless presented an important way that the coffee producers respond to climate change.

Co-generative adaption was present in both case sites, but more substantially in SPN than in Mataquescuintla (Figure 4). Co-generative adaption could be considered a subset of social capital—described as the features of social organization (i.e. civic networks and social trust) that facilitate coordination and cooperation for a mutual benefit (Putnam, 2000)—yet, in popular discussions, the concept of social capital can be fuzzy and applied to almost any social condition (Lang & Hornburg, 1998). With the term co-generative adaptation, I am referring to the intersubjective competencies for responding to the unique challenges of climate change. This intersubjective competency was for members of the Asasapne cooperative a conduit for dealing with complexity together, providing 'strength in numbers' when facing adversity, which they are now able to apply to climate change. A regional analysis of Guatemala in the IPCC 2014 found that participation in organized groups provides various supports and access to information that contribute to adaptive decision-making (Magrin et al., 2014; Tucker et al., 2010). Others have argued that collective intentionality could be a necessary force in fostering structural change in a context of climate change (Manuel-Navarrete et al., 2019), which is also demonstrated by both Asasapne and Colisena cooperatives.

Personal adaptation was also part of the responses to climate change. The quotes above describe how personal convictions, positive attitudes, and prayer—subjective competencies for staying well in times of climate change—offered ways to metabolize difficult emotions, take refuge from hardship, and locate purpose and vision in turbulent times. In Mataquescuintla, this dimension was present in people's experience, yet, I could not discern a deliberate process through which they addressed and worked through their stated emotions of uncertainty, worry, and frustration. In SPN, evidence from respondents' descriptions and participant-observation suggest these were practices or intentional ways that individuals worked with their interiority.

Some of these were faith-based processes. There is a risk that religious narratives may actually be disempowering and lead to fatalistic points of view rather than adaptive action (seen in the quote by Respondent Mata 16 above); yet, other research elsewhere has found prayer can be an adaptation strategy when facing global environmental changes (Pyhälä et al., 2016). The difference here may lie in the quality of awareness brought to bear on the practice and its integration with other quadrants. As the phenomenological practice of prayer is similar to mindfulness and in other studies they have been grouped together (Burke et al.,

2017), here, I will group the prayer practices that respondents referred to under the concept of "mindful climate adaptation," developed by Wamsler (2018). Research in disaster management found that mindfulness and other faith-based practices can have a positive impact and supported coping strategies, improved well-being indicators (such as stress reduction), psychological/cognitive flexibility to adapt to new circumstances, and increased compassion and human potential (Wamsler, 2018). When practiced in organizations, research in climate adaptation has found that mindfulness supported collective and organizational learning with respect to the anticipation of, and coping with, unexpected changes and also enabled the group to access key social resources needed when facing extreme climate events (Becke, 2014; Becke et al., 2012). The findings here suggest that the cooperative in SPN had garnered similar benefits from prayer practices in their organization *when that prayer was integrated with actions in other quadrants*; it was the combination of forms of adaptive responses that together enhanced capacities. Such processes of mindful climate adaptation could be an under-examined way in which people and groups support themselves in dealing with global environmental change.

These interior expressions of adaptation supported other exterior adaptation efforts. This conforms with other research on the importance of the *personal sphere* in generating rapid social change (O'Brien, 2018) and on how certain interior practices can assist individuals and groups in overcoming barriers to climate change adaptation (Gifford, 2011; Moser, 2007). Yet, explains Wamsler (2018, p. 1128), "nevertheless, psychological aspects of climate change and adaptation have so far barely hit the radar of climate change science." The results in Fig. 4 echo this asymmetry towards exterior forms of adaptation over the interior forms. However, these findings also suggest that interior adaptation is nevertheless important and, as Wamsler (2018, p. 1130) said, may assist "individual and collective capacity to deal with increasing risk and uncertainty—through cognitive, emotional, managerial, structural, ontological, and epistemological change processes." In other words, this interior dimension may be inseparable from external action: who we are shapes what we individually intend and what societies we create; "it is the subjectivization process through which subjects produce themselves; what they are and what they can do, how they think, see themselves and others, and how they relate to the world around them" (Manuel-Navarrete et al., 2019, p. 4). These findings underscore the importance of interiority in supporting people's ability to meet and navigate change, and affirm its place in a comprehensive adaptation practice.

6.3. Pathways to and from this moment: Antifragility and transformation

The second step of this pathway case study sought to consider the possible mechanisms for how these two differing outcomes of adaptation—one more inclusive of the four quadrants and one predominantly practical—had come to be in these case study regions. Findings suggested a correlation between the spatial, historical, and ontological aspects in each case and the approaches to adaptation taken. The geographical distance and topology of Huehuetenango had affected its connection with the capital such that it was less modernized and privileged compared to that of the urban center; in other words, perhaps because of this disadvantage, producers had had to secure alternative market arrangements through a critical-structural adaptation. The armed conflict in Huehuetenango (1960–1989) resulted in more community organizing, supported by indigenous, Leftist, and Catholic liberation theology groups, which respondents now drew on as intersubjective competencies. Gender could be another important factor: the higher proportion of women involved in coffee production in SPN may have

contributed to a co-generative adaptation, which warrants further study. For example, is this a tentative finding that women have a broader suite of strategies to draw on in climate change adaptation? Also, the implicit indigenous ontology in Huehuetenango could also be an important factor; for example, the fact that the subjective and objective worlds were not-separate is more common to indigenous worldviews, and in turn may have provided the social-acceptance for engaging in a personal adaptation where needed. The lack of emphasis on personal adaptation in Mataquescuintla may have been due to the context (namely, the intricacies of positionality, gender, and power) in which it was less socially-acceptable to admit vulnerability and share emotionally as a man in public, and even less so to a foreign woman. However, also considering the Ladino ontology of the region, with modern worldviews that tend to separate subjective and objective realities, it also raises the possibility that a technical definition of adaptation had been internalized by these producers, placing less emphasis on interiority.

The phenomenon of becoming stronger through adversity may also be key to understanding the pathways of these cases. SPN had met hardship and built critical awareness and action over decades. Some research has found that exposure to stressors, at least up to a point, can activate adaptive responses and create strength, a phenomenon referred to as *antifragility* (Taleb, 2014). In a context of adapting to natural disasters, specifically flooding, the 'wisdom geographer' White (1945, p. 93) described, "while sorrow and frustration also follow the path of lost lives, broken families and disrupted economy that is etched by floods, these losses are balanced against *psychic profits*." Reflecting personally, one respondent in SPN said:

> One must struggle in life, to proceed forward…and if something in life makes you fall, you don't stay fallen. You rise up. You show to the rest of the world that you are different, you demonstrate to the world that you are who you are, you are a better person. (Respondent SPN 6).

In the case of SPN, there is a strong possibility that this group of producers, having met and overcome multiple stressors, had gained 'psychic profits' and developed anti-fragility. As a result, these producers had a propensity for a more all-quadrant approach that they are now able to draw upon as they face this new set of challenges presented by climate change.

The important point when moving beyond these case studies is not to attempt to replicate the same spatial, historical, and ontological conditions, but rather to deliberately engage the subjective and objective perspectives, in individuals and collectives, that these conditions fostered. In this way, the Integral adaptation framework could be used by policy-makers and practitioners elsewhere to intentionally integrate all four faces of adaptation; such as designing ways to include subjective practices of personal adaptation, making purposeful space for inter-subjective processes toward a co-generative adaptation, and designing for inter-objective procedures to critically interrogate and consciously participate in the structures in which adaptation is occurring. These three other faces of adaptation can be included by those making policies and developing programs alongside the more typical practical adaptation work, which, while indispensable, is limited when used as the sole mechanism for responding to unpredictable change.

Findings here suggest that coffee producers in SPN were doing more than just conforming or adjusting to climate change conditions. By producing fair trade, organic, specialty coffee, even with the possibility of negative outcomes (i.e. farmers who have committed to organic certification could find themselves with limited pest/fungus control options when hit by *roya*) such decisions are

nevertheless made with deliberate consideration of the developmental trajectory of the region. For example, said one respondent, "the most [negatively] affected is nature and if we do not create awareness about this, we will all suffer; sure, we may be able to adapt [technically], but animals and plants suffer from [us] using so many chemicals… if human beings do not become aware of this damage, in a short time we will destroy everything we have, pollution will increase and living beings will die" (Respondent SPN 12). The important point here is not that fair-trade organic is the 'right' path from a normative perspective, it is that the farmers are seeking to consciously participate in the coffee value chain in ways that are more aligned with the values they hold.

In so doing, the cooperative in SPN joins largescale efforts in shifting the trade paradigms for coffee, undergirded by new values for reflexive economies and greater sustainability, and gives producers a sense of their own agency despite the enormity of the climate change issue. Applying Leichenko and O'Brien's definition of transformation (2019), coffee producers in SPN are engaging significant changes in form (i.e. redefining what it means to be a small producer in Guatemala in terms of having agency and resilience), structure (i.e. disrupting the structural dimensions of inequity, exclusion, and unsustainability) and meaning-making (i.e. engaging trade relations on a different set of values, ethics, and meaning). Transformation arises from precisely this kind of "an emergent space for reflection, reframing, and the formation of new pathways for change" (Charli-Joseph et al., 2018, p. 4). By engaging these four quadrants, the very practice of adaptation opened up new ways of viewing the problem and created greater possibilities for transformation.

7. Conclusion

The split between the subjective and the objective has long persisted in society, and particularly in social science, as per the opening Bourdieu (1992) quote. Yet, to maintain it limits the solution-space, which is at best unhelpful and at worst misleading in the face of something as unprecedented in its complexity as is climate change. To reckon effectively with this particular issue, we will need to work on both sides of that subject-object divide. As one such example, I have considered the Integral adaptation framework, demonstrating that the four quadrants of adaptation are present and relevant for how people respond and react to change. These results also suggest that something alchemical is made possible through the synergy of these adaptations as they 'tetra-arise' at the interface of subjectivity and objectivity, in individuals and collectives. Like the adage that says, 'all metal is gold that does not recognize it yet,' adaption when it is realized in a broader and deeper manner may help set the conditions for transformation.

CRediT authorship contribution statement

Gail Hochachka: Conceptualization, Methodology, Data curation, Writing - original draft, Visualization, Investigation, Writing - review & editing.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.worlddev.2020.105361.

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