



Towards quantifying relational values: crop diversity and the relational and instrumental values of seed growers in Vermont

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Abstract

The conceptual promise of relational values, theorized as the principles and virtues of human relationships (with other humans and nature), to motivate sustainability may be observed in its rapid uptake in theoretical and policy domains. Both relying on and impacting nature, agriculture has garnered attention among efforts to apply relational values. However, quantitative measures have received little focus in efforts to operationalize relational values. Guided by the assertion that sustainable agriculture is embedded with both relational and instrumental values (i.e., self-interested ends), this study considers theoretical and methodological challenges and offers a pathway to quantitatively measuring relational values within agriculture, focusing specifically on seeds—an agricultural input embedded with plural values. Drawing on 151 survey responses from seed growers in Vermont, this study assesses how relational and instrumental values are reflected among commercial and non-commercial seed growers and are associated with the presence of crop diversity in their farms and gardens. The findings show that those who sell seeds for income have significantly higher relational values, instrumental values, and crop diversity than those who do not sell seeds. Should these findings be confirmed in future studies, potential exists for policy initiatives encouraging market behavior and its governance to express a range of values beyond instrumental ones exclusively. This paper concludes by arguing that all economic exchange is likely embedded with both relational and instrumental values, meaning that policies and programs that activate a range of values will most likely maximize the impacts of the myriad initiatives pursuing sustainable agriculture.

Keywords Relational values · Social sustainability · Agrobiodiversity · Seeds

Abbreviations

IPBES International Panel on Biodiversity and Ecosystem Services
GMO Genetically Modified Organism
GM Genetically modified

Introduction

Since the 1980s social sustainability has constituted one of the three core pillars of sustainable development (World Commission on Environment and Development 1987), but until recently concerns have existed that the social domain has been largely overlooked and plagued by conceptual

confusion (Eizenberg and Jabareen 2017; Vallance et al. 2011). In the past several years, calls for more dedicated considerations of social sustainability have been met with robust discussion, with multiple theorizations of the social values embedded within sustainability emerging from diverse disciplines (Raymond et al. 2019) and appeals to allow space for multiple lenses (epistemic, procedural, and value) (Kenter et al. 2019). Among these approaches, the idea of relational values—the meaning and importance attributed to human relationships (with other humans and nature)—has gained particular traction, even being incorporated by the International Panel on Biodiversity and Ecosystem Services (IPBES) (Stålhammar and Thorén 2019). According to Chan et al. (2016), relational values fill an intermediate space between—and even link—instrumental values (characterized by efficient means to self-interested ends) and intrinsic values (the worth of an ‘other’ unto itself).

As an activity that both relies on and impacts nature, agriculture in particular has garnered attention among efforts to

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understand the expression of relational values (Allen et al. 2018; Chapman et al. 2019; Gallemore et al. 2022). Jones and Tobin (2018) critique the reductionism that often characterizes agricultural production as a purely instrumental activity and instead theorize that relational values commonly co-exist alongside instrumental values, an assertion for which early empirical evidence exists (Kreitzman et al. 2022). Yet, despite the potential of relational values to explain the underlying processes guiding agricultural decision-making and management, the concept is nonetheless still young in terms of operationalization and application. Further conceptualization of the pathways by which relational values lead to sustainable outcomes is required as are multiple case studies to document those processes across geographic, social, and institutional contexts. To date, empirical analyses of relational values have been almost exclusively qualitative, despite the potential benefits of quantitative measurement to hypothesis formulation, the identification of commonalities and divergences in the expression of relational values across space and time, and representative evidence to inform policymaking (Schulz and Martin-Ortega 2018). This paper thus seeks to apply survey methods to categorize and quantitatively compare the relational and instrumental values underlying the crop diversity maintained by seed growers in Vermont.

Crop diversity provides a useful analytical focus to understand relational values, given that it contains both private and public benefits (Smale et al. 2004). While the private benefits provided by crop diversity include food for direct consumption, products to sell, and risk mitigation against environmental and market factors, crop diversity also generates public benefits such as the biodiversity it contributes, biocultural heritage it helps maintain, and genetic material it conserves (Isbell et al. 2021). Underlying crop diversity is seeds, the carriers of genetic diversity, which have been shown to contain both commodity value as a private good [reflected by the global market dominance of three seed companies (Howard 2015)] and non-commodity value as, for example, a vessel of cultural practice (Graddy 2013; Pfeiffer et al. 2006; Tobin et al. 2018).

A focus on seed growers in Vermont thus presents a compelling focus for analysis. As a place, Vermont is embedded in a 'modern' agrifood system oriented around the goals of yield and profit maximization (Friedmann 2019; Lyon et al. 2021) while also a leader in the United States (U.S.) in the promotion of alternative food movements (Ayres and Bosia 2011; Vermont Sustainable Jobs Fund 2021). As a population, the seed growers of Vermont represent both those who engage in selling seed and others who do not engage their seed activities in markets at all. Such a distinction provides important analytical insight, given that market engagement is assumed to orient around instrumental values, while principles reflective of relational values like reciprocity and

redistribution organize other types of economic exchange (Jones and Tobin 2018). Thus, assessing the qualities of the relationships between seed growers with different market orientations and the seeds that they grow provides opportunity to understand how instrumental and relational values co-exist across different economic behaviors.

This study is guided by Jones and Tobin (2018), who point out that some economic systems may more heavily operate according to a certain set of values than other sets (i.e., instrumental more prominent than relational in market economies) but that all economic systems likely contain both instrumental and relational values. However, empirical evidence is required to understand how these values configure according to different economic orientations. Because this empirical work has yet to be conducted, this study tests the prevalent assumptions that Jones and Tobin (2018) critique: that instrumental values dominate market exchange and relational values dominate non-market economic exchange. This paper thus hypothesizes that (i) those who sell seeds have higher instrumental and lower relational values than those who do not sell seeds and vice versa, (ii) relational values will be more prominent among those who maintain higher levels of crop diversity, and (iii) those who sell seeds will have lower crop diversity because they will be more motivated by instrumental values than relational values. To test these hypotheses, this study relies on survey data. Attempts to measure relational values quantitatively reveals specific challenges to operationalization, for which this paper offers some pathways forward.

Relational values

Interest in relational values has occurred quite recently and rapidly. Although earlier work positioned relational values as an important value category (Jax et al. 2013; Muraca 2011), the treatment that Chan et al. (2016) provided stands as an influential and widely applied conceptualization. Chan et al. (2016) argue that relational values provide a useful value category regarding how people actually make decisions, filling the gap left by the dichotomy of instrumental and intrinsic values. As they write, "Few people make personal choices based only on how things possess inherent worth or satisfy their preferences (intrinsic and instrumental values, respectively). People making decisions also consider how they relate with nature and with others, including the actions and habits conducive to a good life. In philosophical terms, these are relational values (preferences, principles, and virtues associated with relationships, both interpersonal and as articulated by policies and social norms)" (Chan et al. 2018, p. 1462). As a category, Chan et al. (2018) position relational values between, and overlapping with, assigned values (value assigned to objects) on the one hand and moral values

(ideas of what is universally right and wrong) and intrinsic values on the other while also drawing distinction between relational values and held values, the latter encompassing values in the abstract (i.e., fairness, equity, solidarity, etc.). In this consideration, relational values fill a space between, and even bridge, the instrumentalism (economic value) of assigned values and the inherent worth of the ‘other’ (intrinsic values). This middle position is about the meaning that emerges through relationships—and thus value that cannot be explained by instrumental or intrinsic values.

Gaining traction within IBPES, this conceptualization of relational values has proliferated, culminating in a special issue exclusively dedicated to relational values (Chan et al. 2018). Collectively, the articles of this special issue demonstrate the nuances pertaining to the theorization, operationalization, and application of relational values. Himes and Muraca (2018), for example, distinguish between the process of valuation and the content of valuation—the former acknowledging that the social process that takes place in how something becomes valued is always relational and the latter applying instrumental, relational, and intrinsic values to describe what is valued and how value is assigned to that thing. Muradian and Pascual (2018) make the case that the categorization of values as instrumental, relational, and intrinsic is too crude. They argue that because different relationships are underpinned by distinct relational models with distinct orientations towards nature and varying degrees of (non-)instrumental values embedded in them, a typology of relational models can better depict the articulation and expression of relational values (detachment, domination, devotion, stewardship, wardship, ritualized exchange, utilization).

Further complexity in conceptualizing relational values is introduced by different disciplinary lenses. Stålhammar and Thorén (2019) track three approaches based in environmental ethics, ecosystem services valuation, and environmental psychology, arguing that the interest in relational values within environmental ethics on the normative issue of why nature should be valued differs from issues of people’s orientations and behaviors towards nature that are central to ecosystem services valuation and environmental psychology. Efforts have also sought to demonstrate the historical awareness that has existed in social and economic theory of the limitations of the instrumental/intrinsic dichotomy. For example, Massenberg (2019) traces five economic theories that extend social value beyond the narrow focus on individual self-interest central to neoclassical economics. Jones and Tobin (2018) engage with relational values even more explicitly, connecting the recent emergence of relational values (e.g., Chan et al. 2016) to Karl Polanyi’s seminal work on substantive economics. They argue that Polanyi’s (1971[1944]) observation of the historical existence of different organizing principles (i.e., reciprocity, redistribution,

market exchange) underlying economic systems created space for the expression of relational values, even if these non-instrumental values are marginalized by capitalist theory. Polanyi’s idea of the double movement suggests the contingency of instrumental values on relational ones: despite the best efforts of capitalism to disembed economy from society (thus the encouragement of instrumental values), society always counters to provide social protection against the worst transgresses of marketization or it risks destruction (and thus the expression of relational values) (Jones and Tobin 2018).

Operationalizing and measuring relational values

Tension also exists regarding the degree to which relational values are place-based: while some (e.g., Chan et al. 2018) ground relational values in context, others see potential for generalization across contexts (Schulz and Martin-Ortega 2018). These different perspectives have important methodological implications. To date, qualitative methods are most common in studies examining relational values, perhaps because open-ended inquiry is best positioned to document the myriad values that are often simultaneously present and connected in people’s behaviors (Himes and Muraca 2018). Stålhammar and Thorén (2019) make the point that the reliance upon qualitative methods to investigate relational values may be explained as part of the effort to extend beyond the economic (instrumental)—and usually quantitative—assessments common in ecosystem services literature, instead allowing for context-specific explorations undergirded by constructivist epistemologies.

The appeal of qualitative methods also appears to be connected with how relational values are operationalized. As a concept seeking to overcome the limitations of an instrumental/intrinsic dichotomy, relational values account for values embedded in relationships, which include eudaimonic values—those about living a good life as well as how social norms around reciprocity, fairness, care, etc. manifest in society (Klain et al. 2017). Qualitative methods are well suited to operationalize the abstractness of relational values, providing insight into how research participants articulate the importance of their relationships. For example, in a series of interviews, Chapman et al. (2019) identify relational values in the way that farmers and land managers in Washington State often spoke of the connections they feel to their land as well as to past and future communities and family. Similarly, in their study on ecosystem management in the Colombian Andes, Arias-Arévalo et al. (2017) coded responses on an open-ended survey question according to the categories of intrinsic, instrumental, and relational, finding the presence of relational values through themes such as

environmental justice, altruism, sense of place, and social cohesion, and concluding that all three types of values commonly co-existed among those in their sample.

Still, there are benefits to being able to categorize and quantify different sets of values (instrumental, intrinsic, and relational), including an enhanced base of evidence for the generation of hypotheses and to inform policy, as well as an ability to compare and contrast if and how plural values co-exist across time and space (Schulz and Martin-Ortega 2018). Although quantitative efforts that have been undertaken thus far are limited, their findings nonetheless suggest methodological promise. For example, Klain et al. (2017) constructed a survey including six relational value statements, finding that they show potential for a comprehensive index of relational values, but they also recognize that quantitative measures inadequately capture underlying factors that make relationships meaningful such as connectedness and community belongingness and thus also advocate for continued development of qualitative inquiry. Together, qualitative and quantitative methods exploring relational values can achieve complementarity, the former providing deep understandings of the unique relationships that exist in local places and the latter identifying patterns across places.

Regardless of methodological approach, the interconnectedness and co-existence of plural values makes categorization of values, even ones based in qualitative methods, fuzzy. In their quantitative assessment, See et al. (2020) conclude that the expression of relational and instrumental values among respondents in Singapore regarding their orientations towards greenspaces were effectively undifferentiable. Arias-Arévalo et al. (2017) position themes like subsistence and mental and physical health as relational values, as the quotes upon which they draw suggest that they are derivatives of relationships with their local ecosystem, while their treatment of instrumental values rests entirely in the economic realm with a focus on the monetary benefits the local watershed can provide. While instrumental values are assumed to be dominant within a market economy (Polanyi 1971[1944]), they do not operate solely in the context of market economies. In their examination of the benefits of crop diversity, Isbell et al. (2021) point out that private benefits may include those that are not necessarily market-oriented, such as producing planting material for a home garden and enhancing household food and nutrition security. While it is possible that private benefits (those that cannot accrue to two individuals or households simultaneously) emerge from a relational values orientation, as per the analysis of Arias-Arévalo et al. (2017), they also emerge from self-interest. The debate between V.I. Lenin and Alexander Chayanov during the early twentieth century in the USSR demonstrates that instrumental values cannot be sequestered only to market considerations. Though they disagreed about how agricultural transformation should take

place in their communistic society, Lenin and Chayanov were both oriented towards the instrumentalist pursuits of labor productivity and technical progress (Bernstein 2009). While capitalists typically view instrumentalism through the lens of profit maximization, communists focus on utility maximization—but both perspectives are reflective of instrumentalism, just with differing ends (Friedmann 2019; Shanin 1973).

Assuming that instrumental values can be expressed outside of market contexts, then the possibility arises that themes such as subsistence and mental and physical wellbeing may reflect relational values (à la Arias-Arévalo et al. 2017), but they may also be informed by instrumental values, suggesting blurriness in operational definitions. Complexity only multiplies with the insight from Himes and Muraca (2018) that the expression of instrumental or relational values always occurs within a relational process (how something becomes valued). This operational ambiguity is particularly problematic for studies seeking to quantify relational values, which demands discreteness in categories for the purposes of statistical comparison. Thus, what is needed for quantitative measures of relational values is a clear definition providing discernible boundaries between relational and instrumental.

The definition Jones and Tobin (2018) offer for instrumental and relational values provides some assistance, as it bends more towards the operational than the common yet more abstract definition provided by Chan et al. (2016) about the principles, preferences, and virtues of relationships. For Jones and Tobin (2018), value characterization can occur “based on the concrete question: For whom or for what is value intended to be generated?” (p. 69). This definition provides inroads to quantitative operationalization in two important ways. First, it positions relational values within the realm of decision-making, linking underlying value orientations to the decisions that people make (Chan et al. 2018). As Arias-Arévalo et al. (2017) argue, accounting for plural values—relational, instrumental, and intrinsic—is critical to understand what motivates sustainable management practices. Monroy-Sais et al. (2022) make a similar argument, asserting that the different ways that communities manage their plant resources reflect relational values—in other words, decisions about management illuminate the values guiding those decisions.

In addition, the definition provided by Jones and Tobin (2018) closely aligns with what Kenter et al. (2019) classify as part of value intention, which they closely associate with but nonetheless distinguish from value frames and value justifications which is where they situate relational values in their framework of social values. Value intention, defined by Kenter et al. (2019, p. 1442) as “who is being regarded with the expression of values,” tightly connects with the idea that relational values can be assessed according to the

distribution of intended benefits (Jones and Tobin 2018). As Kenter et al. (2019) outline, intention of values may be assessed according to whether it is self-regarding (and thus mapping onto instrumental values), other-regarding (intrinsic values), or both self-regarding and other-regarding (relational values). By assessing the presence of the “other” in decision-making, potential exists to identify if the value of a relationship (the core of relational values) underlies that decision. Applying this approach offers opportunity for quantitative categorization in its ability to assess whether an ‘other’ is regarded explicitly in a particular decision. This is not to suggest that this method is free of limitations: any decision may implicitly value relationships with an ‘other’ even if not explicit. Given that See et al. (2020) found that relational and instrumental values are inextricable, likely no quantitative approach can ever completely disentangle one from the other, but establishing the criteria that the ‘other’ is explicitly regarded in a decision diminishes (though does not completely erase) assumptions of value intention and provides a tractable path forward for the quantitative categorization of relational values.

Relational values, agriculture, and seeds

The rise and current prominence of relational values as a useful value concept within social sustainability has led to its application across diverse fields. Scholars have demonstrated the applicability of relational values to issues including cultural ecosystem services (Brill et al. 2022; Ishihara 2018); environmental management (Arias-Arévalo et al. 2017; Bataille et al. 2021; Skubel et al. 2019; Mould et al. 2020), indigenous worldviews (Gould et al. 2019), ecotourism (Olmsted et al. 2020), environmental education (Britto dos Santos and Gould 2019), and policymaking (Mattijssen et al. 2020). Agriculture has been another point of focus in the emerging literature on relational values, providing an interesting opportunity to explore how valuation occurs through relationships, given that agricultural activity inherently requires interaction between people and nature. In their review, Allen et al. (2018) find that farmers across global contexts commonly operate according to relational values through their commitments to principles such as stewardship, cultural maintenance, and moral duty. According to several previous studies, approaches at the policy and programmatic levels that acknowledge relational values are important to the pursuit of sustainability to address the shortcomings of agricultural policies and governance that typically emphasize either instrumental or intrinsic values (Allen et al. 2018; Chapman et al. 2019; Gallemore et al. 2022). In actuality, however, policies typically focus narrowly on goals reflecting instrumental values such as profit and yield maximization. For example, the economic benefits

that agricultural specialization, a feature of agricultural policy since the Green Revolution, achieves generally comes at the expense of ecological wellbeing (Evenson and Gollin 2003; Klasen et al. 2016).

Jones and Tobin (2018) start from a similar place as Allen et al. (2018) in identifying the partiality of sustainable agriculture initiatives, in that they tend to emphasize either instrumentalism as is common in market-oriented approaches like value chain development and third-party certification or underscore relational values like stewardship and care as is commonly expressed in transformative agricultural visions like food sovereignty and agroecology. Instead of these binary assumptions that tie specific underlying sets of values (i.e., instrumental or relational) to sustainable agriculture projects (i.e., value chain development or agroecology), Jones and Tobin (2018) and others (Arias-Arévalo et al. 2017) posit that plurality likely exists, in which relational and instrumental values can co-exist, albeit with varying levels of degrees and in different configurations. Sustainable agriculture initiatives, especially ones that are organized by principles like reciprocity and redistribution “may embed diverse motivations including self-interest and justice for self and others, stability and solidarity with other people and the natural world, and utility and community wellbeing” (Jones and Tobin 2018, p. 73). Although more evidence is needed, the few empirical studies that do exist find promise in this assertion. For example, in their study of polyculture farmers in the Midwestern U.S., Kretzman et al. (2022) found that instrumentally-driven actions—like what to sell at market—were influenced by relational values like stewardship. Similarly, Monroy-Sais et al. (2022) conclude that both instrumental and relational values are present among those managing plant resources in a highly biodiverse region in Mexico.

In exploring the relational (and instrumental) values that exist within agriculture, seeds provide a worthy focus in that the myriad benefits they contain are well-documented. As one of the most important inputs for crop-based agricultural production, seeds can contain many private benefits as a resource that provides individual gain reaped from yield and profit maximization, risk mitigation, and/or household food and nutrition security (Bellon 2004; Smale et al. 2001). These types of private benefits—particularly those related to yield and profit—are those that market-oriented agricultural initiatives typically seek to fulfill, thus appealing to underlying instrumental values based in self-interest (Isbell et al. 2021). However, public benefits—maintaining biocultural heritage, promoting biodiversity, etc.—are also embedded within seeds and contribute important motivations for the continued cultivation of diverse cultivars, especially among smallholders in the Global South (Burchfield et al. 2019; Graddy 2013; Tobin et al. 2018), although emerging evidence exists that public and private benefits both are also

relevant and important to seed growers in the Global North (Isbell et al. 2021).

The value attached to seeds is also informed by the broader system—the seed system—and its rules and norms governing the production and distribution of seed. Seed systems are often classified into two types: formal and informal. Seeds sold commercially are typically part of formal seed systems, which describe centralized plant breeding for characteristics like yield and distribution based in market transactions (Lipper et al. 2010). Formal seed systems adhere closely to economic systems organized according to market exchange and thus emphasize instrumental values. Within formal systems, seeds have become highly commodified and consolidated, especially since the rise of neoliberalism in the 1980s which has created the conditions for only three firms controlling over half of the global market share (Howard 2015). On the other hand, informal seed systems are farmer-managed, decentralized, typically governed by cultural norms, and often high in genetic diversity. These conditions appeal to economic systems organized according to principles such as reciprocity, reflecting relational values (Lipper et al. 2010; Jones and Tobin 2018). Within informal systems, movements such as seed sovereignty that resist the trend of seed privatization within formal systems have been rising in prominence, seeking to re-embed seeds as part of the commons (Hernández Rodríguez 2022). Seed sovereignty often appeals to relational values through the maintenance of culturally important seeds across generations and through norms governing social relations like reciprocity (Aistara 2012). Thus, the tensions that exist in the way that seeds are valued, itself contingent upon their position within the seed system, provide a compelling opportunity to further understand if and how relational values exist within agricultural systems and whether they can and do co-exist with instrumental values, as Jones and Tobin (2018) theorize.

Methods

To understand how instrumental and relational values influence seed production activities and in turn the presence of crop diversity in farms and gardens, this study uses responses from 151 seed growers in Vermont. The state of Vermont provides a compelling context to investigate the (co-)existence of instrumental and relational values in agriculture. It is marked both by highly commodified production, the dairy sector being most emblematic, as well as a healthy presence of modes of production alternative to the intensive model of production that dominates U.S. agriculture: a prominent place for the Back-to-the-land movement, a leader in sustainable food system planning, and a haven for practices often perceived as sustainable (i.e., organic,

polyculture, etc.) (Ayres and Bosia 2011; USDA NASS 2019; Vermont Sustainable Jobs Fund 2021).

Given the theoretical connections between relational values and Polanyian concepts on which this study builds (Jones and Tobin 2018), seed systems provide interesting insight into a study context that appears emblematic of an embedded agricultural system, one in which full rotations of the double movement (from the disembedding impulse of the market economy to the re-embedding social response) occurs (Polanyi 1971[1944]). For example, in 2016, Vermont became the only state to mandate labelling of GMO food products (those containing GM seed) (Kolodinsky et al. 2018), reflective of an embedded reaction to the deregulatory (disembedded) approach toward GMO labeling at the national level. The commercial presence in the seed sector existing in Vermont is also marked by an orientation toward embeddedness. For example, High Mowing Seeds, a small but prominent organic seed company, encourages seed saving (when legally possible), supports the Open Source Seed Initiative, regularly donates seeds to seed libraries and other community-based organizations within the state, and positions itself as an advocate and agent for sustainable change in the food system. Likewise, the network of informal seed savers (e.g., the existence of seed libraries and seed saving groups) motivated to grow seed by myriad factors—cultural and environmental alongside economic—further indicates an embedded response to the broader disembedding trend of formal seed systems marked by high degrees of corporate consolidation (Isbell et al. 2021). Vermont thus provides a research site in which it would be expected that a plurality of values exists: its diversity in agricultural production practices offers the potential to compare whether instrumental and relational values exist across commercial and non-commercial activities—the former providing fertile conditions for instrumental values and the latter for relational values (Jones and Tobin 2018).

With seeds and the crop diversity they produce as the analytical focus, the study recruited individuals who grew seeds for themselves, to share, or to sell as the target population. Recruitment occurred through listserv announcements from organizations likely connected to the target population (i.e., Northeast Organic Farming Association of Vermont, University of Vermont Extension, etc.) and on Front Porch Forum, an online community forum that covers the state. In total, 253 Vermonters provided their contact information. After receiving IRB approval from the University of Vermont on September 30, 2019, an online survey was deployed in winter 2020 using the online software LimeSurvey. With questions focusing on the motivations for engaging in seed production, the types of crops for which they grew seed, perceived challenges and barriers to seed growing, as well as demographics, the survey was reviewed by a panel of experts, field tested, and pilot tested to enhance validity and

reliability. Adapting the Tailored Design Method (Dillman et al. 2009), a pre-announcement was sent 1 week prior to the survey being sent out followed by weekly reminders for a 4-week period. Upon receiving responses, the sampling frame was reduced from 253 to 242 due to eligibility issues among respondents. In total, 151 complete responses were received for a response rate of 62%.

Despite a relatively small sample, the respondents collectively represent different degrees of engagement with informal and formal seed systems. Most respondents grow seeds as part of their gardening activities (89%) and to produce for home consumption (95%). While engagement with the informal seed system was more common among respondents than commercializing seeds, nearly one quarter grew seed for income, providing opportunity to assess how value orientation shifts with market engagement (Table 1). Among the 34 respondents who sell seed for income, 27 indicated that they sold seeds for supplementary income and 7 for primary income. Although selling seed was less common within the sample, regular engagement with the formal seed system nonetheless commonly occurred alongside high levels of participation in the informal seed system: while 97% and 87% sourced at least some of their seeds from either their own stock or other farmers/gardeners respectively, 87% and 63% of respondents also reported small-scale seed

companies and conventional seed companies respectively as sources of some of their seed.

To test the three hypotheses guiding this study, data transformation was necessary to construct variables reflecting crop diversity, instrumental values, and relational values. As a common measure of crop diversity, species richness, a simple count of the number of different species present, was used (Jones 2017). Respondents indicated the different species they grew for seed among a list of 51 food crops as well as provided the number of varieties of each species they grew. While species richness provides insight into interspecific diversity, crop diversity also occurs intraspecifically (within species through varietal diversity). Although measures of varietal richness are much less common, precedent does exist to approach varietal richness in the same way that species richness is captured (through simple counts) (Tobin et al. 2018). Following this approach, the total number of varieties a respondent grew for seed was summated. The species richness among respondents ranged from a single crop to 38 with a mean of 10.7 and standard deviation of 8.6. In terms of varietal richness, respondents ranged from a single variety to 244 of them with a mean of 27.6 and a standard deviation of 32.0. Given issues with normality, both species and varietal richness were logarithmically transformed for bivariate and multivariate analyses.

For instrumental and relational values, analysis drew on responses from 29 items asking respondents the importance of each in motivating their seed growing activities on a scale from 1 = Not at all important to 5 = Very important (Appendix A). These questions aim to assess the decision-making processes of seed growers, in accordance with Monroy-Sais et al. (2022), who argue that decisions and actions around management of plant resources are reflective of underlying value orientation. Categorization of these statements followed Kenter et al. (2019), who identified the intention of values as being self-regarding, other-regarding, or both. This approach to categorization closely associates with how Jones and Tobin (2018) conceptualize relational values, which they define as where value is intended to accrue. However, applying Kenter et al. (2019) avoids making assumptions about what respondent's ultimate intentions are in selecting the importance of each item, instead focusing on the explicit recognition of a relationship with an "other." Because instrumental and relational values are more relevant to agriculture than intrinsic values given that agricultural production demands interaction with nature (as opposed to, for example, conservation efforts that see value in nature whether or not humans interact with it), statements were categorized as only either instrumental or relational (Jones and Tobin 2018).

Adhering to this categorization approach, each of the 29 items was assessed according to the explicit consideration of the 'other,' such that those items that primarily focused on the self or the household were categorized as instrumental,

Table 1 Sample characteristics

	n	%
Gender		
Female	105	70.9
Male	43	29.1
Location		
Urban	42	28.2
Rural	107	71.8
Race		
White	140	92.7
People of Color	11	7.3
Education		
Below bachelor's degree	29	20.3
Bachelor's degree	52	36.4
More than a bachelor's degree	62	43.3
Sell seed for income		
Yes	34	22.5
No	117	77.5
Income level		
\$0-\$24,999	19	14.3
\$25,000-\$49,999	30	22.6
\$50,000-\$99,999	57	42.8
\$100,000 or more	27	20.3
Age (n = 148)	56.3 (M)	13.8 (SD)

while those that explicitly contained an ‘other’ were categorized as relational. For example, producing food for home consumption was categorized as instrumental as a statement that is primarily self-regarding. Even though people who produce food for home consumption may also be motivated to generate other indirect benefits that are relational in nature such as contributing to community resilience, these relationships were not explicit in the statement. On the other hand, improving soil quality was categorized as relational as an activity that explicitly recognizes the ‘other’: within this item, the health of the soil is built (other-regarding) and soil productivity is enhanced (self-regarding). Although it is possible that individuals seek to improve soil quality for primarily instrumental motivations (e.g., enhancing yield), doing so is predicated on recognizing the relationship with the soil, thus reflecting relational values. This is not to suggest that any of these categorizations are exclusively relational or exclusively instrumental, given the difficulty in distinguishing between instrumental and relational values (See et al. 2020), but the approach taken reflects the prominence of instrumental and relational values within each item. Furthermore, because 29 different items are assessed relating to the same single action (growing seed), the multi-dimensional nature of this action is revealed. Returning to the example of producing food for home consumption (categorized as an instrumental value), it is possible that individuals do so to express concern about corporate consolidation in the food system, but this is included as a separate item (and categorized as a relational value).

Following previous studies, which make the point that relational values can also reflect human–human relationships in addition to human–nature ones (e.g., Arias-Arévalo et al. 2017), items such as bringing together community members were also considered other-regarding and thus classified as relational. Jones and Tobin (2018) also point out that relational values can also be present in relationships between individuals and society in terms of contributing to social wellbeing, and therefore items related to food system concerns such as corporate consolidation of the seed industry were categorized as relational. The literature is also clear that morality and spirituality are also relevant to relational values (Chan et al. 2018; Gould et al. 2019) and are thus classified accordingly (see Table 2).

To use these relational and instrumental measures for analysis, the lists of motivations representing relational and instrumental were assessed for reliability through Cronbach’s alpha scores and both were found to have adequate reliability ($\alpha=0.944$ for relational values and $\alpha=0.702$ for instrumental values). Responses were then summated according to each scale (relational and instrumental) to reflect the degree to which their seed growing reflected instrumental and/or relational values. The summated scores were subsequently used for a variety of bivariate and multivariate statistical

analyses to test each of the three hypotheses. For each, independent t-tests were first used to isolate the key variables of interest, followed by linear regression models to control for demographic factors.

Findings

The first hypothesis guiding this study proposes that those who sell seeds have higher instrumental and lower relational values than those who do not sell seeds and vice versa. To begin, descriptive statistics were run to ascertain the importance that those who sell seeds and those who do not place on each of the items comprising the scales of relational and instrumental values (Table 2). In terms of instrumental values, general convergence existed among those items most important across both those who sell seeds and those who do not, with producing food for home consumption, producing planting material, nutritional benefits for my household, and obtaining more knowledge as the top four across both groups. Interestingly, the market-oriented items were scored as among the least important by both those who sell seeds and those who do not, although the mean scores for starting/maintaining a business and meeting market demand were substantially higher among those who sell seeds than those who do not. Other variation across the two groups also existed. Among those who do not sell seeds, combating community food insecurity, connecting to nature, and encouraging pollinator populations were the top four most important, while those who sell seeds ranked promoting sustainable agriculture, encouraging pollinator populations, connecting to nature, and supporting local seeds systems as the top four (with several more being ranked very closely behind).

According to independent t-tests, this first hypothesis is partially supported. As assumed, those who sell seeds for income have significantly ($t=-6.7$, $p<0.001$) higher instrumental values ($M=32.4$, $SD=4.6$) than those who do not sell seeds ($M=26.6$, $SD=4.1$). However, unexpectedly, the responses of those who sell seeds for income also reflect significantly ($t=-5.4$, $p<0.001$) higher relational values ($M=86.1$, $SD=18.9$) than those who do not ($M=71.1$, $SD=10.5$). To assess whether these relationships are maintained when demographic factors are also considered, two linear regression models were run, the first testing instrumental values and the second relational values (Table 3).

The results of the regression models further support seed sales as a variable that provides important insight into the degree to which seed growers operate according to relational and instrumental values. As with the t-test findings, the regression analyses indicate that those who sell seeds hold higher instrumental and relational values than those who do not sell seeds and is the variable with

Table 2 Mean scores of items reflecting relational and instrumental values according to selling seeds

	Sell seeds			
	No		Yes	
	n	M (SD)	n	M (SD)
Instrumental				
Produce food for home consumption	113	4.84 (0.43)	33	4.58 (0.62)
Produce planting material for my farm/garden	111	4.68 (0.63)	33	4.70 (0.77)
Nutritional benefits for my household	111	4.49 (0.87)	33	4.79 (0.69)
Obtain more knowledge	112	4.38 (0.84)	33	4.58 (0.79)
Leisure/hobby	111	4.20 (1.03)	33	3.76 (1.19)
Save money	111	3.67 (1.26)	33	3.91 (1.33)
Start/maintain a business	105	1.62 (1.10)	33	3.55 (1.27)
Market demand	101	1.57 (1.04)	33	3.12 (1.45)
Make money	107	1.53 (1.00)	33	1.32 (1.30)
Instrumental composite score	89	3.37 (0.55)	31	3.98 (0.47)
Relational				
Combat food insecurity in my community	111	4.49 (0.87)	33	4.18 (0.95)
Connect to nature	110	4.44 (0.94)	33	4.61 (0.96)
Encourage pollinator populations	106	4.17 (1.19)	32	4.75 (0.56)
Promote sustainable agriculture	108	4.13 (1.13)	33	4.76 (0.56)
Adapt varieties to my environment	108	4.06 (1.06)	33	4.52 (0.71)
Preserve traditional agricultural practices	110	3.98 (1.13)	33	4.55 (0.90)
Improve soil quality	111	3.96 (1.26)	33	4.36 (1.14)
Contribute to biodiversity	107	3.78 (1.23)	32	4.47 (0.95)
Concern about the prevalence of GMO crops	108	3.77 (1.45)	33	4.30 (1.10)
Adapt to climate change	106	3.74 (1.22)	33	4.48 (0.66)
Promote open access to seeds	105	3.67 (1.29)	33	4.45 (0.97)
Support local food systems	111	3.65 (1.37)	33	4.58 (0.86)
Build climate resilience in my community	104	3.46, 1.39	32	4.41 (0.97)
Moral beliefs	105	3.45 (1.50)	32	4.00 (1.36)
Concern about consolidation of seed companies	106	3.40 (1.51)	32	4.22 (1.03)
Educate others in my community	106	3.31 (1.36)	33	4.30 (0.98)
Bring together community members	105	3.14 (1.43)	33	4.12 (0.99)
Promote diversity in food systems	104	3.02 (1.60)	32	3.22 (1.56)
Spirituality	107	2.97 (1.58)	32	3.41 (1.56)
Meet people	107	2.52 (1.34)	32	3.50 (1.24)
Relational composite score	92	3.59 (0.92)	30	3.46 (0.49)

the strongest explanatory power. Within the instrumental model, the only other significant predictor variable is location, with those who live in rural areas more likely to have higher instrumental values. In the relational model, the only other variable of significance was gender, with females expressing higher degrees of relational values. Though not the focus of this study, both of these findings warrant further research to better understand the intersections of gender, geography, and values. In particular, pursuing quantitative measures of instrumental and relational values, as this study seeks to do, would provide the ability to assess how these dynamics shift across context and thus provide insight into how value orientation is informed by

factors like demographic patterns (e.g., rural/urban status) and social norms (e.g., gender).

The second hypothesis speculates that relational values will be more prominent among those who maintain higher levels of crop diversity, while the third hypothesis of this study is that those who sell seeds will have lower crop diversity because they will be more motivated by instrumental than relational values and vice versa. With crop diversity serving as the dependent variable across both hypotheses, a common set of tests provided insight into both. As with the first hypothesis, the findings from the series of statistical tests conducted provide partial support for the second and third hypotheses. In terms of the second hypothesis, results

Table 3 Linear regressions of seed grower characteristics on instrumental and relational values

Variable	Instrumental model (n = 104) Standardized coefficient	Relational model (n = 106) Standardized coefficient
Gender (0 = male)	0.17	0.20*
Location (0 = urban)	0.18*	0.12
Race (0 = people of color)	-0.03	-0.07
Education ¹	-0.08	-0.04
Sell seeds for income (0 = no)	0.41**	0.37**
Income ¹	-0.12	-0.07
Age	-0.01	0.06
Constant (unstandardized)	3.47**	3.47**
Adjusted R ²	0.28	0.16
F value	5.46**	3.85**

**p* < 0.05, ** *p* < 0.001

¹Education and income were included as ordinal variables

from Pearson product-moment correlations indicate that higher crop diversity is maintained by both those with higher relational values and, unexpectedly, those with higher instrumental values: (*r* = 0.29, *p* < 0.01 for (lg₁₀) species richness and relational values; *r* = 0.32, *p* < 0.01 for (lg₁₀) of species richness and instrumental values; *r* = 0.32, *p* < 0.01 for (lg₁₀) of varietal richness and relational values; and *r* = 0.29, *p* < 0.01) for (lg₁₀) of varietal richness and instrumental values). To more robustly assess the effects of selling seeds and instrumental values and relational values on crop diversity, four linear regression analyses were conducted to account for both species and varietal richness and both instrumental and

relational values. Table 4 presents the findings from these regression models.

The results from the regression models are generally consistent with the results from the bivariate analyses. Relational and instrumental values are significant predictors of crop diversity in three of the four models, with only the model including the effects of instrumental values on varietal richness emerging as not significant (Model 4). Thus, strong evidence emerges that relational values are significant predictors of higher levels of crop diversity, whereas higher levels of instrumental values also appear to have some effect on the presence of crop diversity, a somewhat surprising finding given the assumptions that market engagement operates according to self-interested pursuits of maximization (Friedmann 2019; Lyon et al. 2021).

Regression model results also provide substantial evidence to reject the third hypothesis. As other scholars have connected economic value and market engagement with instrumental values (Arias-Arévalo et al. 2017; Chan et al. 2018), the commodification that occurs during the process of selling seeds would be expected to associate closely with instrumental values, and in turn, favor more specialized agricultural production (Klasen et al. 2016). However, across all four regression models, selling seeds is the only variable that consistently and most powerfully predicts species and varietal richness, thus indicating that, at least among the seed growers in this sample, selling seeds also indicates individuals who are important contributors to crop diversity. Further, because both relational and instrumental values are positively associated with crop diversity, the assumption that the third hypothesis makes about instrumental values associating with lower levels of crop diversity is also not supported. Instead, the findings suggest that those who sell

Table 4 Linear regressions of seed grower characteristics and instrumental and relational values on crop diversity

Variable	Model 1 Species richness (lg) (n = 106) β	Model 2 Species richness (lg) (n = 104) β	Model 3 Varietal richness (lg) (n = 105) B	Model 4 Varietal richness (lg) (n = 103) β
Gender (0 = male)	0.06	0.06	0.04	0.04
Location (0 = urban)	-0.06	-0.06	-0.15	-0.14
Race (0 = people of color)	-0.11	-0.12	-0.08	-0.10
Education	-0.12	-0.13	-0.14	-0.14
Sell seeds for income (0 = no)	0.23*	0.24*	0.29**	0.35***
Income	-0.02	-0.01	0.05	0.09
Age	0.00	-0.02	-0.06	-0.08
Relational values	0.23*	-	0.25*	-
Instrumental values	-	0.25*	-	0.15
Constant (unstandardized)	0.79**	0.62	1.15***	1.22**
Adjusted R ²	0.17	0.19	0.23	0.22
F value	2.58*	2.94**	3.68***	3.40**

p* < 0.05, ** *p* < 0.01, * *p* < 0.001

seeds have both higher relational and instrumental values as well as higher levels of crop diversity than those who do not sell seeds.

Discussion

Guided by Jones and Tobin (2018), who speculated that plural values co-exist in sustainable agriculture initiatives, albeit in different configurations depending on the initiative, this study assessed relational and instrumental values and their influence on the presence of crop diversity in the farms and gardens of seed growers in Vermont. Based in the literature, which has characterized market activity as primarily driven by instrumental values and non-market activity as primarily relational (Arias-Arévalo et al. 2017; Chan et al. 2018; Jones and Tobin 2018), this study hypothesized that those engaged in seed sales would possess higher levels of instrumental values and grow less crop diversity while those who do not sell seeds would be more strongly motivated by relational values and maintain more crop diversity. Overall, partial support emerged. While higher levels of instrumental values did exist among those who sell seeds (support for hypothesis 1), they also reflected significantly higher relational values than those who do not sell seeds (contrary to hypothesis 1). Support for the second hypothesis existed in that higher levels of relational values associated with more crop diversity, but the finding that higher instrumental values also associated with more crop diversity diverged from the second hypothesis. And the evidence suggests that the third hypothesis should be rejected, given that those who sell seeds maintain higher levels of crop diversity, contrary to expectation.

Collectively, these findings provide several interesting insights. At the most basic level, they build upon the previous empirical evidence that exists supporting the supposition made by Jones and Tobin (2018) that both instrumental and relational values co-exist within sustainable agriculture (Kreitzman et al. 2022; Monroy-Sais et al. 2022). Although economic value has been tightly linked with instrumental values (Arias-Arévalo et al. 2017; Chan et al. 2018), and social theory has long warned of the perils of markets exclusively operating according to instrumental values (Polanyi 1971[1944]), the findings from this study—with those who sell seeds having significantly higher instrumental and relational values than those who do not sell seeds—suggest that relational values enjoy a prominent presence among seed growers in concert with their strong orientation towards instrumental values. In interpreting these results, it is important to keep in mind the study context of Vermont, where the agricultural system has a storied history of social responses (embeddedness) to the disembedding influence of market forces. Within this context, the decision-making

of seed growers in this study who sell their seeds appear to reflect the double movement occurring within agriculture in Vermont, by which the pursuit of instrumentalism is balanced by an orientation toward relationality. However, an open question remains regarding if expressions of relational values present among those in this study's sample remain consistent across other agricultural contexts (pointing to quantitative measurement as a worthy endeavor) (Schulz and Martin-Ortega 2018). Thus, studies across different contexts that represent varying levels of embeddedness constitutes an important future research endeavor.

In addition to the sociocultural context, another important consideration is how market engagement may influence the presence and prominence of relational values in decision-making. In this study, although a sufficient subsample engaged in some market behavior for the purposes of analysis, only seven individuals sold seeds as a source as their means of primary income, an inadequate representation in the sample to assess if and how value orientation shifts across degree of market engagement. As has long been recognized in social theory (e.g., Chayanov 1986), producers who are not fully immersed in markets are able to maintain alternative logics to capitalism, pointing to the importance of analyzing how market integration affects the expression of myriad values among agricultural producers. Nonetheless, this study provides preliminary evidence that relational values co-exist alongside instrumental values across the divide of non-market and market behavior, providing grounds to hypothesize that this is consistent even among those who are fully immersed in markets, though the configuration and expression of values may vary according to the degree of market engagement.

Beyond the basic observation of plurality in values, however, lies the possibility that instrumental values do not just co-exist with relational values but are actually predicated on them. Following Polanyi (1971[1944]), Jones and Tobin (2018) interpret the double movement as being driven in part by the interplay of instrumental and relational values. Rather than—or perhaps in addition to—providing a link between instrumental and intrinsic values (Chan et al. 2016), relational values may also anchor instrumental and intrinsic values, a possibility that appears to align with Himes and Muraca (2018) who distinguish between the always relational process of valuation and the content of valuation (what and how things are valued). This possibility again converges with Polanyi (2018), who grounded his view of substantive economics in the understanding that all economic systems emerge from the relationship that humans have with their natural and social environments. From this vantage point, the question is not whether relational values always exist, but rather how plural values are configured in the economic systems that emerge from these relationships. Thus, in future studies, it would be expected that relational

values are always present, given that they precede all economic behavior. Interesting questions, however, emerge in the prospect of examining how the prominence of instrumental and/or relational values varies contextually according to the dominance of the disembedding force of markets and the strength of the countering social response. Examining how the expression of values manifests in different types of agricultural systems (for example, the embedded context of Vermont compared to the seemingly disembedded context of commodity grain production in the Midwest) would illuminate the contextual effect on the configuration of values.

Should future studies with more robust sample sizes and considering other agricultural services, goods, and resources continue to support the existence of value pluralism, potential exists for high impact policy initiatives that seek to create space for market behavior and its governance to express values in addition to those that are instrumental. Market efforts seeking to embed other values in addition to economic value have been pursued over the last several decades within the agrifood system, both internationally and domestically (Hardesty et al. 2014; Hellin and Hignman 2005; Hinrichs 2000) and should be used as examples to pursue sustainable market initiatives with careful attention to buffering against the tendency for economic values to dominate and distort other social and environmental values. For seeds, the findings from this study suggest opportunity to identify market niches leveraging both social and environmental considerations. Among the growers who sell seeds, their responses indicated particular interest in environmental benefits such as encouraging pollinator populations and adapting varieties to local environments as well as social benefits such as promoting sustainable agriculture and preserving traditional agricultural practices. Thus, how commercial opportunities for seeds can embed such values as cultural meaning and environmental adaptation is worthy of consideration.

Any seed value chain development seeking to establish market niches must take careful account of specific market type. In this study, little data were collected on the specific market outlets in which growers sold, a detail useful to include in future empirical investigation, although it is reasonable to assume that informal and local or regional markets were those most likely used by respondents, given that most of the growers who sell seed did so for supplementary income. Because (seed) markets are diverse, and not all operate according to the same rules, some are more likely to provide appropriate fits than others (Ferris et al. 2014). While the seed companies that dominate the global market function rigidly according to market principles of privatization, excludability, and profit maximization (Howard 2015; Lyon et al. 2021), smaller scale seed companies and especially ones that are already likely oriented towards plural values (i.e., sell organic seeds, subscribe to the Open

Seed Source Initiative, and/or have a commitment to social justice) offer promising partners for values-based seed value chain development.

At the same time—and again depending on if the findings from this study are confirmed in future research—the implications are that policy and programmatic attention should not exclusively focus on the commercial realm to promote seed activities that are critical to crop diversity, the maintenance of which is in the public interest (Bellon 2004). Non-commercial activity among the seed growers in this study was most common, and these growers are critical to the presence of crop diversity in the Global North (Isbell et al. 2021). Thus, as opposed to relying predominantly on market mechanisms to promote the public good, other levers should also be activated. Across both the public and private benefits of crop diversity, considering how relational values may be stimulated may open up new approaches to policy-making and program development. For example, programs that incentivize conservation-oriented management (i.e., conservation payments, tax credits, etc.) based on healthy relationships between humans and their agroecosystems (in this study, examples include adapting varieties to the local environment, encouraging pollinator populations, improving soil quality) would likely be met favorably among the seed growers in this study. The private benefits that these types of approaches generate should be accompanied by those that more explicitly target broader environmental and social benefits. For example, in this study, combating community food insecurity, was highlighted as particularly important among both those who sell and those who do not sell seeds, pointing to opportunities for programs to link local seed distribution to community food justice initiatives (i.e., community gardens for low-income populations) and investment in seed libraries, an emerging institution seeking to enhance local access to seeds in ways that contest the dominant consolidated seed system (Soleri 2018). Among the seed growers in this sample, preserving traditional agricultural practices was also highlighted as an important motivation, suggesting that other initiatives may be promising, such as public awareness campaigns of the cultural heritage of varieties that have been successfully undertaken in agricultural value chains in other geographic contexts such as native potatoes in Peru (Devaux et al. 2020).

Before any policy or programmatic initiative commences, the findings from this study need further support. The small sample size, narrow geographic focus, and underrepresentation of commercial seed growers mean that the findings need to be interpreted with care. Yet, the process of validating these findings point to the benefit of quantifying relational values, an effort to which this paper seeks to contribute. As Schulz and Martin-Ortega (2018) argue, assessing how values manifest across contexts opens up methodological possibilities and provides imperative insight to tailor and

target policy and program efforts effectively and appropriately. For example, although seed growers in this study did not identify spirituality as particularly important, this would likely shift for indigenous populations (Gould et al. 2019; Kala 2017). However, preserving traditional agricultural practices is an important motivation that the growers in this study share with farmers in other geographic and cultural contexts (Graddy 2013; Pfeiffer et al. 2006). Quantitative measures are particularly well suited to trace how instrumental and relational values are configured and expressed across time and space, providing opportunity to assess demographic characteristics like gender identity and place of residence, two factors that emerged as significant in this study that require future exploration. This is not to suggest that quantitative measures should replace or even achieve equal standing to qualitative approaches in empirical assessments of relational values. While quantitative measures are best positioned to reflect patterns across scales, qualitative inquiry is best suited to describe the meaning and substance of relationships in particular contexts which allow for rich depictions of the diverse ways that instrumental and relational values co-exist and are expressed (Himes and Muraca 2018; Stålhammar and Thorén 2019).

Overall, the quantitative approach applied in this study yielded theoretically compelling results, suggesting that relational values are not overshadowed when individuals enter market contexts, an insight that interrogates a core assumption of neoclassical economics as primarily self-regarding (Kenter et al. 2019; Polanyi 1971[1944]). This is not to suggest that the survey instrument used in this study does not need refinement. In seeking to contribute to the development of quantitative measures of relational values, this study highlights the careful consideration that needs to be undertaken in operationalizing terms. The approach this paper took was informed by the definition offered by Jones and Tobin (2018) which focuses on value intention and applied the categories of value intention articulated by Kenter et al. (2019). This method positions relational values within the realm of decision-making, following the argument within the relational values literature (e.g., Arias-Arévalo et al. 2017) that decisions link value orientation to land management (Monroy-Sais et al. 2022). This linkage between decision-making and underlying values, however, requires further empirical analysis through, for example, efforts that correlate the value statements developed by Klain et al. (2017) with assessments of value intention as undertaken in this study. In addition, empirical analysis should also assess how the approach taken in this study converges with the actual intentions of where value accrues, as per the definition provided by Jones and Tobin (2018). These types of triangulation efforts are critical to avoid any potential bias that exists in the approach that this study took through organizing responses about

decision-making into value categories. In other words, both the approach and the findings of this study should be treated as preliminary, requiring further verification in future studies. As this paper reveals, no single quantitative metric of values can likely avoid the conceptual and operational blurriness that exists between the categories of instrumental and relational, but confidence in metrics can increase if associations are found between measures. Additionally, while the survey items could be feasibly categorized according to instrumental and relational values, they did not prove to easily capture subdimensions, such as instrumentalism focused on profit as opposed to other pursuits of utility or the differences between human-nature and human-human relationships. Although the quantitative approach of this paper should not be taken as final, it provides an important initial step in further articulating the theoretical pathway from values to sustainable outcomes and a quantitative methodological approach to account for the expression of instrumental and relational values.

Conclusion

The conceptual promise of relational values to explain and motivate behaviors oriented towards sustainability may be observed in its rapid uptake across both theoretical and policy domains (Chan et al. 2018). The basic premise that values embedded in relationships underlie people's interactions with the world around them adds useful and needed depth to the instrumental/intrinsic dichotomy that has long dominated the policy arena (Chan et al. 2016). The application of relational values to agriculture (Kreitzman et al. 2022; Monroy-Sais et al. 2022) has supported the conjecture offered by Jones and Tobin (2018) that both relational and instrumental values co-exist. The findings from this study add further nuance: at least for the seed growers in this study, those who engaged in market activities were even more highly oriented towards relational values than those who engaged in purely non-commercial seed activity. As Jones and Tobin (2018) assert, favoring one set of values over another likely misses the opportunity to maximize the plural activities that collectively pursue sustainable agriculture, especially if future studies continue to demonstrate the inextricability of instrumental and relational values, perhaps due to the possibility that instrumental values emerge from relational values. For something like seeds, an agricultural input embedded with plural values and meanings, the findings from this study suggest that both relational and instrumental values are important. Should public goods like crop diversity be recognized as worthy of protection and investment, policies and programs that activate both instrumental and relational values are most likely to generate the highest impact.

Appendix A

Survey items used for relational and instrumental values categorization

How important are these factors in your decision to produce planting material? Please indicate the importance of each factor. Use the following scale to answer each question: 1-Not important at all; 2-Not very important; 3-Neither unimportant nor important; 4-Important; 5-Very important

Item	1	2	3	4	5
Moral beliefs	0	0	0	0	0
Spirituality	0	0	0	0	0
Preserve traditional agricultural practices	0	0	0	0	0
Connect to nature	0	0	0	0	0
Leisure/hobby	0	0	0	0	0
Produce food for home consumption	0	0	0	0	0
Meet people	0	0	0	0	0
Make money	0	0	0	0	0
Nutritional benefits for my household	0	0	0	0	0
Combat food insecurity in my community	0	0	0	0	0
Bring together community members	0	0	0	0	0
Build climate resilience in my community	0	0	0	0	0
Produce planting material for my farm/garden	0	0	0	0	0
Promote sustainable agriculture	0	0	0	0	0
Adapt to climate change	0	0	0	0	0
Contribute to biodiversity	0	0	0	0	0
Improve soil quality	0	0	0	0	0
Concern about the prevalence of GMO crops	0	0	0	0	0
Concern about consolidation of seed companies	0	0	0	0	0
Save money	0	0	0	0	0
Market demand	0	0	0	0	0
Encourage pollinator populations	0	0	0	0	0
Obtain more knowledge	0	0	0	0	0
Educate others in my community	0	0	0	0	0
Start/maintain a business	0	0	0	0	0
Adapt varieties to my environment	0	0	0	0	0
Promote open access to seeds	0	0	0	0	0
Support local food systems	0	0	0	0	0
Promote diversity (gender, race, etc.) in food systems	0	0	0	0	0

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