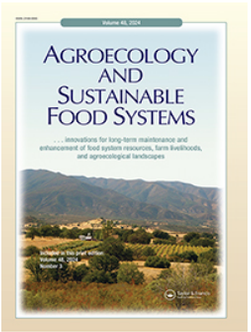

Agroecology and Sustainable Food Systems

ISSN: (Print) (Online) Journal homepage: www.tandfonline.com/journals/wjsa21

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To cite this article: C. Shambu Prasad, Arnab Chakraborty & Deborah Dutta (23 Feb 2024): The need for ground-up transitions: exploring the knowledge politics of agroecology in Gujarat, India, Agroecology and Sustainable Food Systems, DOI: 10.1080/21683565.2024.2316124

To link to this article: https://doi.org/10.1080/21683565.2024.2316124

Published online: 23 Feb 2024.

AGROECOLOGY AND SUSTAINABLE FOOD SYSTEMS
https://doi.org/10.1080/21683565.2024.2316124

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The need for ground-up transitions: exploring the knowledge politics of agroecology in Gujarat, India

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ABSTRACT

Despite a plethora of emerging alternatives under the broad rubric of agroecology, sustainable transitions in Indian agriculture are caught between institutional inertia and lock-ins of its vast agricultural establishment on the one hand and a proactive state promoting a natural farming. This push for Zero-Budget Natural Farming (ZBNF), while welcome as an alternative, also raises several questions on the nature of knowledge production and dissemination. This paper explores the knowledge politics around top-down "skilling regimes" and the principles and paradigms that emphasize social learning. We explore the multiple practices, meanings of agroecology among farmers, government agencies, and civil society organizations in the state of Gujarat. The action research included a survey of practices of 250 farmers in 12 districts, interviews, and stakeholder workshops. Insufficient investments in community-based extension mechanisms and lack of collaboration between state and civil society were features of the policy implementation. The absence of innovative platforms to facilitate knowledge dialogs and learning among actors to advance agroecology increases the gap between policy goals and its actual realization in practice. Programs for upscaling agroecology, we suggest, need to embed the diversity of technical and institutional processes through creating learning alliances to facilitate knowledge dialogs across dissimilar actors.

KEYWORDS

Agroecology; Sustainable transitions; Knowledge politics; Learning alliance

SDG

SDG 3: good health and well-being, SDG 5: gender equality, SDG 12: responsible consumption and production, SDG 13: climate action, SDG 17: partnerships for the goals

Introduction

The agrarian crises and the sustainability imperative

Farmers of India experienced extreme weather events (heavy rains, floods, landslides, heat and cold waves) on 314 of the 365 days affecting 1.96 million hectares (ha) of crop area in 2022 and 86% of days in nine months of 2023. An increase in number of days with extreme temperatures or rain has caused a decline in quality and size of seeds across India resulting in fall in productivity in wheat and rice.[1] In 2023, the unusually hot February experienced in India led to a distress sale of onions with a farmer receiving as little as Rs 2 (1

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cent) for 500 quintal of onions.[2] Groundwater extraction that spurred the Green Revolution has made India the world's largest consumer of groundwater for agriculture.[3] Rising input costs and stagnating output prices coupled with low yields make for low returns. Rural households in several Indian states experience negative growth in real net incomes. High dependence on external inputs – seeds, fertilizer, and irrigation water, coupled with increased indebtedness – has meant that Indian farmers are experiencing deskilling (Stone 2007), a loss of agency, "agricultural individualization," and "knowledge dissonance" (Vasavi 2012).

Visible forms of agrarian distress have manifested in nation-wide farmer protests forcing state and central Governments to reconsider policies like the farm bills of the Government of India in 2020 (Narayanan, 2021). Policies focused on productivity and populism are ill-equipped to deal with the vast changes and crisis in Indian agriculture and manifestations of a deeper socio-ecological crises permeating food systems (Kumar et al. 2020) and a formidable feritlizer subsidy that was Rs 2.5 trillion ($ 30 billion) in 2022–23.

While the rationale for a sustainability transition in agriculture continues to get stronger and articulated in discussions on food systems, its representation in academic literature is on the lower side. A review of literature of published articles on sustainability transitions in India indicated that there is a missing emphasis on "agriculture" in sustainability transition studies even as research on Indian agriculture has paid little attention to the challenges in sustainability transitions. Sustainability transition literature worldwide has increased significantly in the last decade. The Scopus search conducted through Title-Abs-Key query for, "Sustainability Transitions" OR "Sustainable Transitions" yielded 2689 results. Only 214 of these though were related to agriculture or food systems. Most articles are on renewables, mobility and set in urban contexts. The articles from an emerging economy like India with a large population in rural areas indicate that while there were 36 articles overall only six of these were on transitions in agricultural with many articles looking at renewable energy (see Figure 1). Literature on agricultural transition in India is almost non-existent although the research on sustainable transitions (ST) continues to grow.[4]

Ghosh et al. (2021) point to the need to decolonize sustainability transition studies by acknowledging everyday struggles faced in the Global South and addressing questions of

power, informal institutions, inequality, and injustice that permeate transitions. The transition to sustainability in agriculture is not navigated as easily because existing frameworks do not adequately account for power relations and knowledge hierarchies in developing country contexts (Prasad 2016). The persistence of the linear or pipeline model of innovation deters alternatives that emerge outside the agricultural research establishment and sustainable transitions in agriculture might require investment in newer

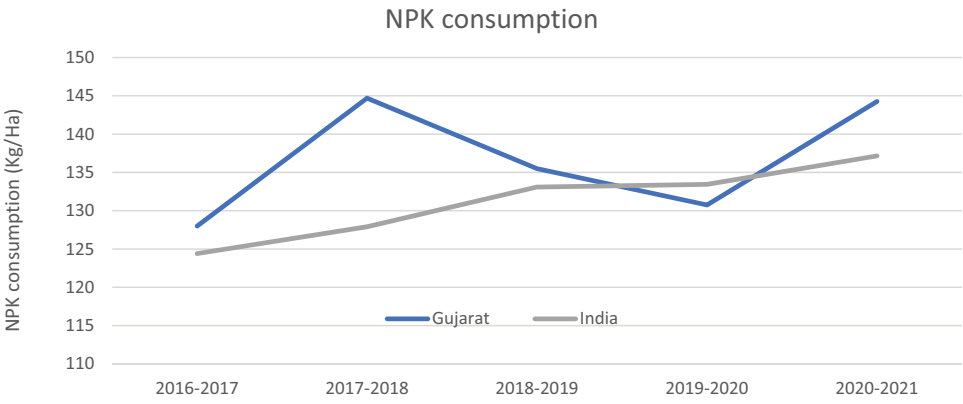

Figure 1. NPK consumption in Gujarat compared to country average.

institutional forms, such as innovation platforms, innovation networks, and learning alliances (Klerkx et al. 2013; Schut et al. 2015). This paper seeks to fill this gap through an empirical study of the spread of natural farming in Gujarat.

Locked-in institutional set-ups and emergent shifts

Policies that encouraged building industrial supply chains, according to Kumar, "built on the twin characteristics of scale and standardised quality, the industrial logic transformed both ends of the chain – it reduced the biodiversity on the farm as well as the diversity on our plates by narrowing the band of crops and varieties that were produced and consumed" (Kumar, 2023: 4). This trajectory has multiplied the risks for the farmers from an economic standpoint, while diminishing the resilience of the ecosystem to withstand the effects of climate change.

This dominant industrial logic driving mainstream agrarian practices can be traced to the Green Revolution (GR) in India during the 1960s that relied on a public-funded farm extension system to push for high external inputs (high yielding variety of seeds, chemical fertilizers and irrigation) high-productivity agricultural practices at the expense of alternate experiences, innovations, and knowledge of farming communities (Marshak et al. 2021). The Indian agricultural research and knowledge institutions were created to support the GR agricultural regime (McNeill 2007; Pearse 1980) and thus failed to either "domesticate agriculture science" (Ramanjaneyulu et al. 2009) or draw from indigenous knowledge. Lack of critical feedback and hierarchical implementation arrangements have created structures that are resistant to new ideas and tend to undermine the validity or potential of grassroots knowledge (Kilelu et al. 2011). There is systemic resistance underlying the separation

between research and extension, with institutional arrangements mostly hooked to agricultural research's conventional transfer-of-technology approach (Prasad, 2005).

Scholars have been claiming that the Indian agricultural research system along with the overall institutional set-up have been locked into a socio-technical regime that allows for productivity increase, without accounting for the socio-economic and ecological consequences of these production practices. As a result of solely top-down nudges, constructive spaces for dialogue and learning from field experiences are almost wholly missing within formal research frameworks. The established regimes tend to optimize existing processes, becoming "locked-in" into particular technologies and socio-economic rationales (Vanloqueren and Baret 2009). Agricultural science centers, known as Krishi Vigyan Kendras (KVKs), are an integral part of this system of technology transfer. The KVKs however lack identity, recognition, and dignity within the R&D institutional landscape. In the absence of regular capacity building of the scientists deployed and their being overburdened with administrative tasks, few KVKs are able to engage with local communities and enable them to transit toward sustainability (Balamatti 2022). Even the successful KVKs have limited capacity for community outreach. Because of this lack of connect with the community, they fail to empower the rural youth to tackle the structural factors which lead to their alienation from agriculture .[5]

However, despite the rigid and isolated systems of the Indian agricultural establishment, there have been spaces for "creative dissent" by agronomists who have carried out unconventional research and managed to engage effectively with wider communities (Prasad et al. 2012). Together, such dispersed collaborations have existed in multiple forms ranging from organized development initiatives, farmer collectives, participatory guarantee schemes for organic farming, etc. Local and international networks led by Civil Society Organizations (CSOs) have enabled the articulation and translation of an alternative paradigm for sustainable transitions within agriculture from outside formal research channels (Münster 2021; Tyagi and Kumar 2020; Bharucha, Mitjans, and Pretty 2020).

In recent decades, the agroecological movement gained traction through the wide adoption of Zero Budget Natural Farming (ZBNF) by the Karnataka Rajya Raitha Sangha (KRRS), a farmers' group associated with the global La Via Campesina movement. Natural Farming as a set of practice is based on identification with native bio-resources like native cows, earthworms, and soils. It also presents an alternate ontology, based on ancient knowledge, to the scientific experts (Munster, 2018). Subhash Palekar, the charismatic proponent of ZBNF, championed it as a social movement and captured the imagination of many major stakeholders and the phenomenal popularity of the movement led it to become "institutionalized" within the policy of Andhra Pradesh in 2015 (Flachs 2021; Khadse et al. 2018) and later in the states of Himachal Pradesh and Gujarat.

The popularization and institutionalization of ZBNF that began in Andhra Pradesh through its program APZBNF (later renamed as Andhra Pradesh Community managed Natural Farming) in 2016 extended to Himachal Pradesh soon and was even renamed after Subhash Palekar as SPNF in 2018. The National Academy of Agricultural Sciences (NAAS) in 2019 opposed the move to promote ZBNF citing food security and farmer income concerns as well as lack of scientific validation.[6] However, the apex body for planning in India, the NITI Aayog (National Institution for Transforming India) had a strong endorsement of natural farming that later found budgetary allocations for promotion too. A NITI Aayog document covering an inter-state consultation remark, - "It was concluded that ZBNF is a social movement, and the *government should lead it* (emphasis added)."[7] What started as a broader endorsement of supporting organic farming through the *Paramparagat Krishi Vikas Yojana* (PKVY) in 2016 where states were provided financial assistance over three years in contiguous clusters to enable farmers to shift to organic farming, a sub-plan within PKVY – BKPK or *Bharatiya Prakritik Krishi Paddhati* was started from 2019–20 that sought to work on farms with exclusion of all synthetic chemical inputs and promotes on-farm biomass recycling with major stress on biomass mulching, use of cow dung-urine formulations and other plant based preparations. An estimated 0.4 million hectares area has been brought under BPKP. The Government of India has recently formulated a National Mission on Natural Farming (NMNF) aimed at up-scaling BPKP to promote natural farming across the country that would cover 0.75 million hectares by developing 15,000 clusters in 4 years.[8]

The strong endorsement of natural farming in recent years has caused fissures within the Indian agroecology movement with organic farming proponents critical of the exclusion of organic farming and the over-emphasis on the cow as the only source for bio-inputs. [9] A recent study points to over thirty sustainable agricultural practices prevalent in India (Gupta et. al, 2021). A national coalition of CSOs, the National Coalition for Natural Farming, has also emerged since 2020 that sees Natural Farming "as the direction and process of transition towards a more local, resilient and adaptive *agroecology* based farming" (emphasis added).[10]

The incipient spread of natural farming is recent but raises several questions on sustainability transitions in general and agroecologyin India in particular. These range from the knowledge categories of inclusion and exclusion. Agroecology, despite its significant scientific standing as a discipline and field of study internationally, is conspicuous by its absence from Indian agricultural universities. Despite its widespread use by CSOs and farmers groups, an examination of 27 state university agricultural curriculum of the four-year Bachelors of Agricultural Science degrees revealed that agroecology is not seen as a discipline or domain but treated as a geographical classification (agroecological zones) by the scientific establishment. There are very few or no credits in

most schools on organic farming and the exposure at best is theoretical with no practical engagement[11] and can be seen as a manifestation of top-down "skilling regimes" (Carlisle et al, 2019). Knowledge on agroecology thus largely is situated outside formal agricultural science establishments who have historically been opposed to any investments, collaborations, and innovations from outside formal research (Prasad et al. 2012).

What are the discussions and debates on the principles and knowledge paradigms of agroecology? Given this politics of knowledge on agroecology in India, that includes a shift from "organic" to "natural farming" the study seeks to understand how does natural farming translate in practice on farmers' fields in Gujarat? How do farmers perceive sustainable agricultural practices and make sense of these multiple streams of knowledge, and what does this mean for managing sustainable transitions in the agricultural sector.

Sustainable transitions in Gujarat

Gujarat is the largest producer of major cash crops like cotton, groundnut, tobacco, cumin, and sesamum in India and its commercial crops model has translated into a growth rate higher than national average and seen as an ideal for increasing farmers' incomes (Gulati, Roy, and Saini 2021). This gap is evident in the popular dairy sector that contributes a major part of the agricultural incomes (22%), while nationally it is only 8%. Well-developed rural infrastructure and strong cooperatives in the state have been significant factors in this growth story (Shah et al. 2009). Critics of this model point to the exclusion of small-farmers and marginalized groups as well as its longer term sustainability (Sejuti 2015; Shah and Pattnaik 2020).

Figure 1 shows the rising consumption of chemical fertilizers in recent years that is higher than the national average. With a burgeoning fertilizer bill there is a case for significant reduction of fertilizer use.

A recent state-wide study by a civil society organization revealed that the nitrogen content was found to be generally low in all the regions of the state (except Kachchh hinterland and coastal Saurashtra). Farmers were using much more chemical fertilizer than that recommended by experts and the soil organic carbon in samples across the state were found to be lower than the officially reported ones through the soil health cards.[12] The state government's focus on soil health has been low and restricted to following central government schemes.

On its part, the Government of Gujarat announced its first Organic Agriculture policy in 2015 to wean farmers away from chemical farming and in 2017 established the Gujarat Organic Agricultural University (renamed as the Gujarat Natural Farming Science University), the first of its kind in India. Translating the intent to implementation at the ground has been tardy. For example, the central government has not released the funds for PKVY in

the second phase due to lack of expenditure in the first phase. The uptake in schemes like the *Mahila Kisan Sashaktikaran Pariyojana* (MKSP), that promotes sustainable agriculture through women's Self-Help Groups (SHGs), has been significantly lower than other states. It is only recently that the government of Gujarat has been trying to become one of the best performers in Organic agriculture and has launched different local schemes. The Gujarat government claims 0.7 million farmers are practicing natural farming and over a million trained.[13] How widespread has this been on the ground? What novel extension mechanisms have been used and what have been the perceptions of farmers on natural or organic farming? To answer these questions the team undertook a survey of farmers across the state between April – July 2022.

Designing an exploratory study on agroecology in Gujarat

This study draws on the understanding of agroecology as a movement, science and practice (Wezel et al. 2009) and focused on "bringing people to the centre of a system" (FAO 2017, 13) in line with the core principle of agroecology. However, the science and practice of agroecology remain on separate plains of knowledge. In the literature, "agroecology" and "food-systems" emerge as distinct themes (Ewert, Baatz, and Finger 2023), highlighting the domains of science and, practice and/or movements of agroecology. Therefore, in order to bring these domains, together, there is a need for a more participatory and transdisciplinary research agenda (Ewert, Baatz, and Finger 2023; FAO 2017). While this is widely reflected in the agroecology literature, research involving multiple stakeholders in the research process as collaborators, or co-researchers is limited (Ohly et al. 2023). In order to emphasize the role of collaboration in the research design and implementation of multiple stakeholders, the authors have drawn on past experiences of using systems thinking in foods systems (Prasad 2009), initiatives in building learning alliances in Odisha (Prasad 2016) and a series of facilitated dialogs in Gujarat on scaling agroecology.[14] The action research began with an effort to bring together multiple stakeholders in the domain of sustainable agriculture in Gujarat through an innovation system approach (Klerkx et al. 2013).

Given the complexity of innovation systems compared to the traditional institutional structures of agricultural extension, there is a need to use diverse research methods to assess the innovation capacity and adoption processes within specific contexts (Schut et al. 2015). As we show in section 3.1. we have assessed the nature of the innovation system for agroecological practices in Gujarat through stakeholder workshops with members from CSOs, activists and academics institutions, followed by in-depth interviews. The interviews were conducted with representatives from government agencies like the KVKs and Agricultural Technology Management Agency (ATMA)[15] that were followed up with interviews with three agri-education administrators or

scientists, one organic farming activist, and one agri-entrepreneur specializing in organic farming. To better understand the context of farmers and their engagement with these institutions, visits were undertaken to farmers' fields and interviews were taken up with seven farmers with more than 10 years of experience of agroecology-based farming practices. Further, we also interviewed three male and three female farmers who are in the process of transitioning to agroecology- based farming practices. As part of the study, we participated in the strategic meetings and other exercises of the NCNF and the government's events aimed at popularizing sustainable agricultural practices, like the Pre-Vibrant Gujarat Summit on agri-business and food-processing in December 2021 that led to the Prime Minister pushing the natural farming agenda.[16] We mapped the knowledge network using actor-oriented tools (Biggs and Matsaert 2004).

The team also engaged with multiple experts beyond Gujarat to compare the policy landscape of the state with those of other state governments in India.

Beyond an understanding of the "innovation capacity" of the emerging innovation system for promoting agroecology-based practices, it is crucial to understand the real-world complexities, to enable institutional learning for adaptive management (Armitage, Marschke, and Plummer 2008). Furthermore, innovation platforms need to develop their internal indicators for situation assessment and evaluating their performance. These indicators and tools for evaluation can only be effective through the implicit participation of the stakeholders in development and implementation throughout the life-cycle of the innovation platform (Schut et al. 2017).

Therefore, based on the discussion with different stakeholders, we designed a learning tool which looked at important aspects of the innovation system, based on the key indicators of agroecological transitions, identified by the stakeholders. The final survey tool had five parts with 60 questions. The survey was designed for a situation assessment in terms of – 1) the socio-economic context of the farmers and the ownership of relevant assets considered important for agroecology-based practices (livestock, water conserving irrigation, access to labor, etc.), 2) practices of the farmers like, fertilizer and other input application, along with the choice of crops that are grown through what they consider agroecology-based practices and, 3) post-production activities like marketing channels, processing and sources of information and knowledge. The results of the situation assessment are presented in section 4.2. The survey also had a section on knowledge dissemination, that supplemented our understanding of the innovation system.

The survey tool was implemented across 13 districts of Gujarat (Figure 2) among 288 farmers who were in operational areas of 12 CSOs who were part of the NCNF coalition in Gujarat and were involved in sustainable agriculture. This covered the major socio-demographic regions, the tribal belt (including the Dangs district that was declared an organic district), the affluent

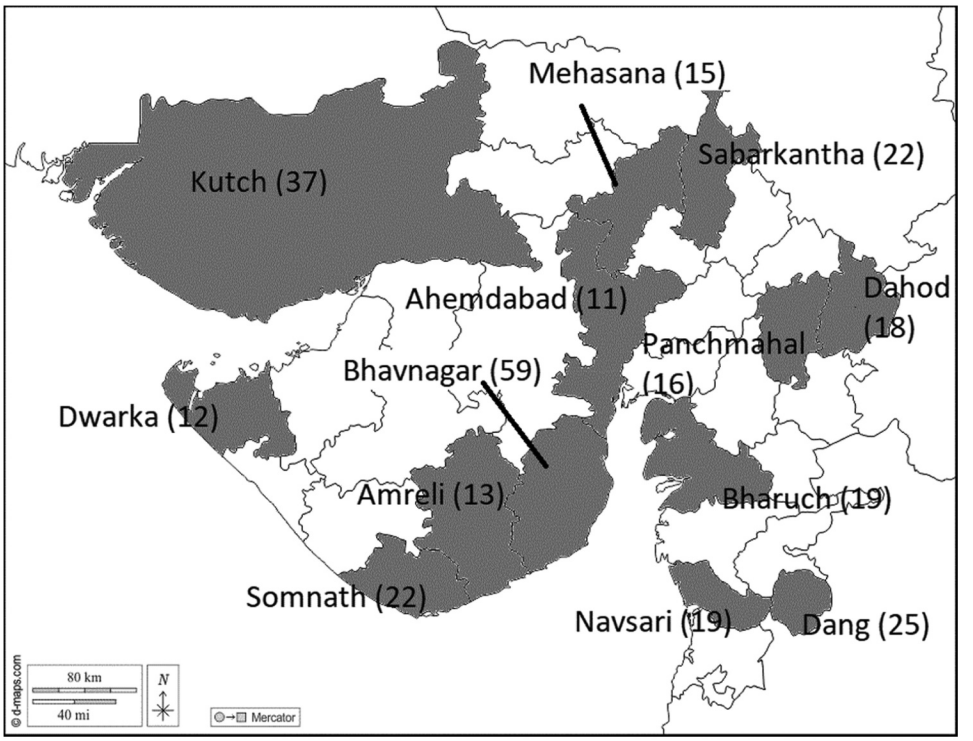

Figure 2. Spatial distribution of interviews.

Saurashtra and Kutch regions, central Gujarat and the coastal belt. The involvement of CSOs was critical for the study and their inputs were taken in the survey design and roll out.

The 288 farmers were 67% male and 33% female and while the ratio was higher than most farmer surveys it did not sufficiently capture the increasing feminization of agriculture.[17] 60% of the farmers were small and marginal, owning less than 2 hectares of land, 58% of them were from the Other Backward Community (OBC). Literacy levels were moderate and 54% of farmers were educated beyond 10th standard and on average the population has adopted agroecological practices in the last five years indicating a slow trend of experimentation among farmers.

In the spirit of participation, the survey was carried out with the involvement of six students pursuing their Bachelor in Vocational Studies (B.Voc) programme on Organic Farming at Lokbharti Gramvidyapeeth, at Sanosara in Bhavnagar who were engaged under an internship program.[18] The design of the B Voc program involves students from rural background, who are interested to take up vocations as farmers, farm managers or become agri-entrepreneurs. The students are not only equipped with theoretical knowledge of organic farming, but also through extended internship programmes working with successful farmers or agri-entrepreneurs.[19]

Their knowledge of organic farming came in handy during the survey, while they were engaged in a process of transformative learning (see Dutta, Prasad, and Chakraborty 2023).

Following a pilot survey, the survey tool was shared with development practitioners, activists, and farmers to validate the accuracy of technical terms, the significance of the themes covered as well as the relevance for policy, through a workshop. The deliberated and extended participatory processes with practitioners meant that the tool was finalized only after reviews and the process of involving stakeholders also built the learning alliance on agroecology in Gujarat.

The questionnaire was translated into Gujarati and administered through a paper-based interview. It was later compiled through a computer assisted personal interview software (Kobo Toolbox), to create a standardized dataset.

Findings and discussion

Mapping knowledge networks: understanding innovation capacity for agroecology

Based on our participatory exercises and multi-stakeholder engagements, the major actors and their inter-linkages promoting agroecological practices in the state of Gujarat were mapped (Figure 3).

The Governor's office, coalitions of CSOs, and the agricultural establishment were identified as important actors. All agencies along the chain of command are accountable to these three entities in some form or the other. We recognized that the pioneer or "champion" farmers are directly contacted by the ZBNF groups and the farmer friends from ATMA, along with KVKs and are accountable to the research establishment and the Governor's office. The presence of the Governor, a constitutional head, as a key actor is an anomaly in Gujarat and needs to be contextualized. Acharya Devvrat, an educationist with links to the right wing non-governmental movement, the Rashtriya Swayam Sevak Sangh or RSS, was appointed the Governor of Gujarat in July 2019. He had experiences of natural farming in his educational institute in Haryana and was pro-active in getting the state to shift toward natural farming.[20] The Gujarat government first articulated its intent to promote ZBNF in 2019 by inviting Subhash Palekar to train large number of farmers through a workshop. The Gujarat government also announced the creation of formal and informal educational initiatives around agroecological practices.[21]

Significantly, though unlike other states such as Andhra Pradesh and Himachal Pradesh that took natural farming to scale by significantly investing either in community-based extension and/or involvement of Civil Society Organisations, Gujarat had made no institutional change or

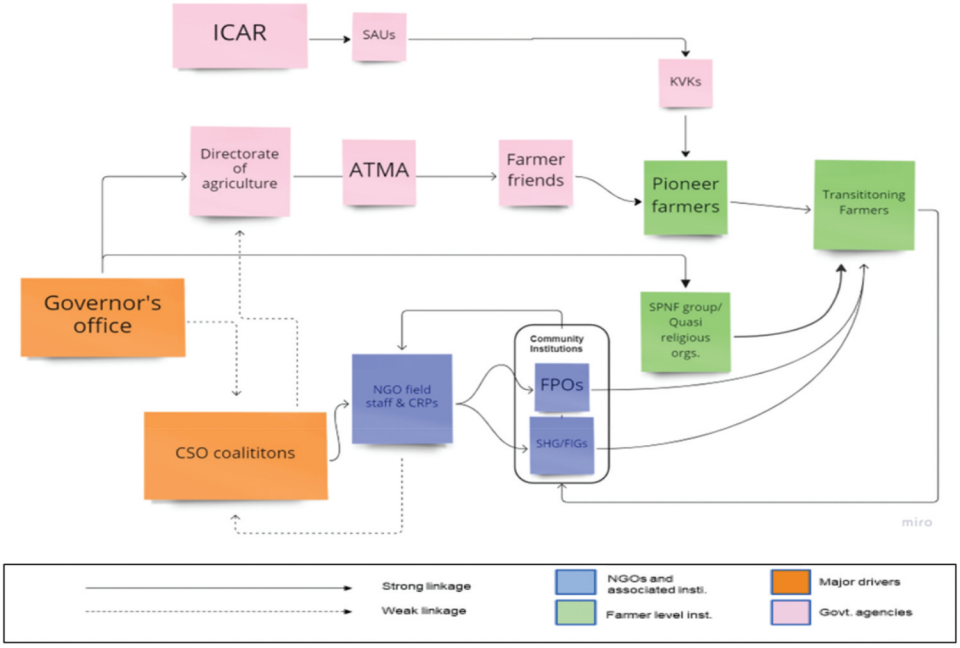

Figure 3. Actor-linkage map of the agroecological knowledge ecosystem in Gujarat.

investment in the Department of Agriculture. The same institutions that were promoting Green Revolution were expected to overnight shift to promoting natural farming with little building up of capacities and no special funding either. Our field visits and interactions with stakeholders indicated that the main mechanism of transition to natural farming were through the Agricultural Technology Management Agency (ATMA) in each district. However, these institutions were understaffed and had not been sufficiently trained in bringing about the shift but were given targets. Often the disbursement of funds through the "desi cow" scheme was seen as proof of adoption of natural farming. This led to tall claims of 0.25 million farmers practicing natural farming and Gujarat being a leader in the country in two years' time.[22] Apart from unverified claims on numbers transiting was the shift in discourse from the broader agroecological to the narrow natural farming.[23]

As shown in Figure 7, CSOs and their member-based organizations also have direct linkage with marginal transitioning farmers, apart from connections with many farmers owing to other projects related to natural resource management. However, the linkage between the CSOs and the government mechanisms is weak, which has also prevented inputs from the transitioning farmers to reach the Governor's office or government agencies. The only feedback that is received by the government agencies is from the pioneer farmers.

Government agencies in states like Andhra Pradesh (Veluguri et al. 2021), Himachal Pradesh (Fitzpatrick, Millner, and Ginn 2022), have actively sought the partnership of civil society organizations in the state. However, while Gujarat too has promoted ZBNF, the nature of collaboration with CSOs is low or non-existent as summarized in Table 1.

When compared to the states of Himachal Pradesh and Andhra Pradesh, Gujarat lacks community institutions to enable social learning like the farmer field schools or women's self-help groups. Similarly for marketing, the focus on certification has been in favor of larger farmers who can afford organic certification, while states like Andhra Pradesh have focused on group certification.

In line with our findings about the information network, the survey revealed that for 55% of the farmers the CSOs that they were associated with were the primary source of information with a third getting to know about agroecological practices through other farmers. Very few (<5%) mentioned ATMA and Youtube as the first source of information. This reiterates the need for community-based organizations supported by NGOs and peer-learning among farmers in spreading information about new practices (Table 2).

Farmers require information and support to carry on agroecological practices in frequent intervals to enable their transition. For information related to

Table 1. Comparison of policy landscape in AP, HP and Gujarat.

	Gujarat	Andhra Pradesh	Himachal Pradesh
Organic farming policy support	Organic Policy, 2015, ZBNF since 2019	Experiments since 2004 through CMSA and ZBNF since 2015	Through Prakritik Kheti Khushal Kisan Yojana (2018)
Main Promotion agency and govt agency in field	Organic Cell; ATMA	Dedicated institution RySS; Line departments of agriculture	Natural Farming Unit; ATMA
Community institutions and grassroot agents	Master farmers	Natural Farming Fellows, CRPs, Rythu Bharosa Kendras/Farmer Field schools	Field schools, Women groups, Community resource persons (CRPs)
Key partners	SAUs, Religious-political groups	NGOs, State Rural Livelihood Mission, APPI, GIZ	NGOs, SAU
Input subsidies or support	Input Support to Desi Cows, Natural farming Kits	Bio-Input Resource centers at community level.	75% subsidy on drums required to make inputs for natural farming.

Note: State Agricultural Universities (SAU), Azim Premji Philanthropic Initiatives (APPI), Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ).

Table 2. Knowledge network of farmers.

	Number of farmers received info. on (n=282)	
Sources of Information	Practices	Marketing
CSO	142	105
Other farmers	89	74
Youtube videos	53	14
FPO	48	40
ATMA	29	12
Read about it in magazine/newspaper	15	83
Others	16	16

marketing, newspapers and magazines appear as another important source of information. ATMA and other public extension agencies are not major sources of information. 82% of the farmers have attended some form of training session and two sessions on average. Peer learning plays an important role; 42% of the farmers noted that they had asked other farmers to attend a training session. The policies for organic and natural farming though are meant to make this trickle into a movement and the farmers reported receiving very little or no state support. Existing policies available to the farmers in Gujarat, also do not clearly address these challenges. In fact, the most commonly accessible schemes are Soil Health Cards and the *Desi Gay Sahay Yojana [Support scheme for native cow breeds]*, which is the state government announced, input subsidy scheme for indigenous cows in July 2020 with farmers eligible for Rs 900 per month for rearing of indigenous cows thus excluding other livestock rearers.[24] Both schemes are focused toward providing support to the farmers in production. The latter scheme was accessed by 53% of the farmers surveyed, which is less than the number of people who own Desi cows. Schemes focused on marketing, specifically certification at group or individual levels are not available to the farmers. This situation has left most farmers to navigate the terrain on their own.

Practices, opportunities, and motivation for transition

The farmers in the sample were not novices but were in the process of transiting away from chemical agriculture and hence the survey was meant to help us understand the pathways of transition for the farmers, as well as the motivation for these transitions. Figure 4 shows the distribution of farmers reporting practice of agroecology.

Most of the farmers are presently in the transitioning stage (≤3 years since adopting any agroecological practice), or have recently crossed this threshold, with the average being 5 years. Moreover, there are regional disparities. 33 of the 39 pioneer farmers (more than 10 years of adapting of any agroecological practices) in the sample come from Kutch which has the highest average land holding size. And only two women farmers are pioneer farmers in the sample. The sample reflected more marginal than small farmers in terms of land size.

Figures 5 and 6 show the main crops of the surveyed farmers and given the larger number of farmers from Saurashtra and Kutch cotton was the main crop used by the farmers where the potential for agroecological farming is relatively low. Green vegetables were the most reported for agroecological use. This has high agroecological potential but largely grown for subsistence. Horticulture where organic/natural potential is high was not common among surveyed farmers.

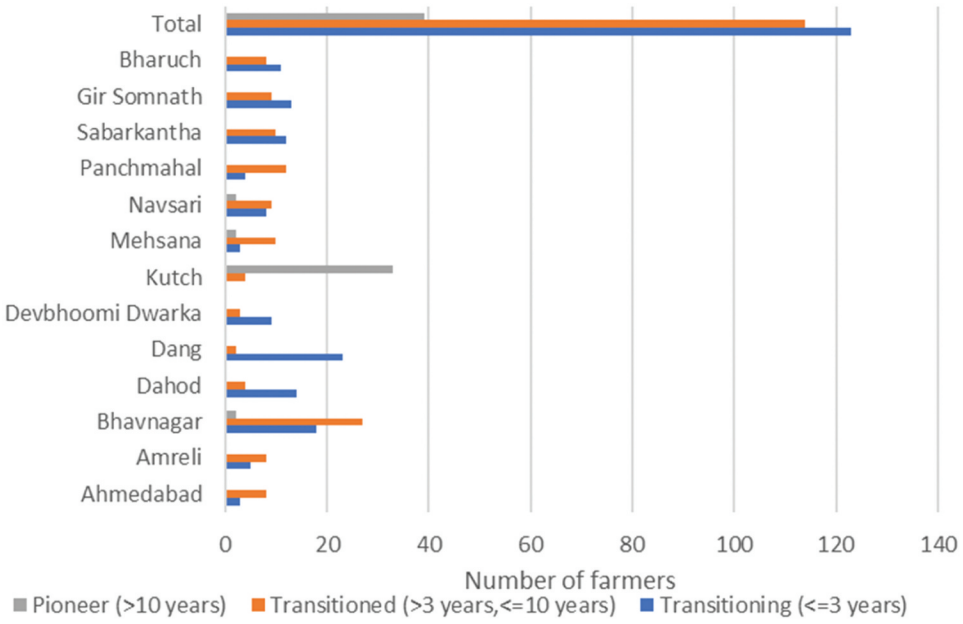

Figure 4. Number of farmers disaggregated by district and years of experience in agroecology-based farming practice ($n = 276$).

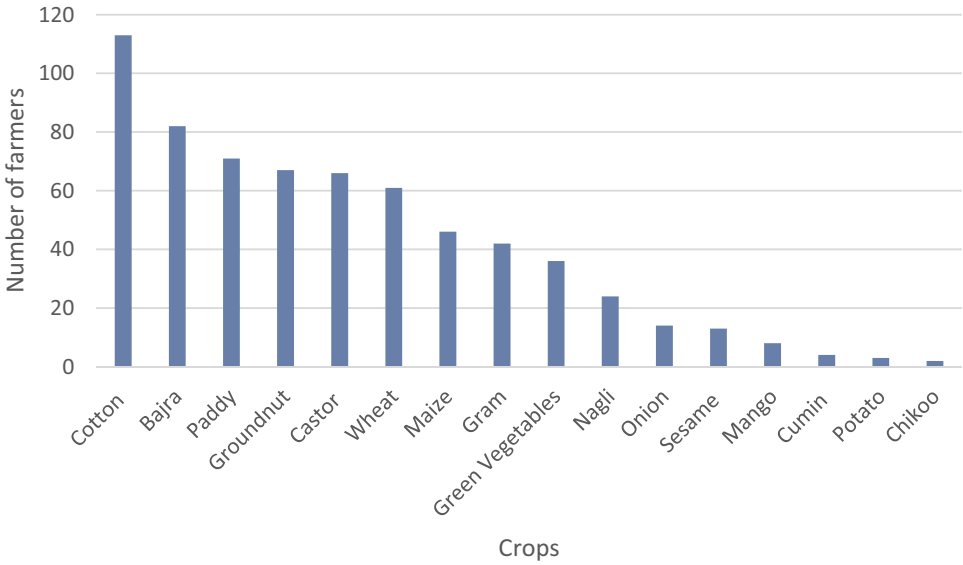

Figure 5. Main crops of study participants *Nagli is the local name for Finger Millet.

The trend of growing certain crops for market (commercially) or for subsistence is varied across districts and is largely defined by the nature of market and other facilities available to the farmers, as well as the demographic profile of the farmers. A comparison of respondents from Bhavnagar

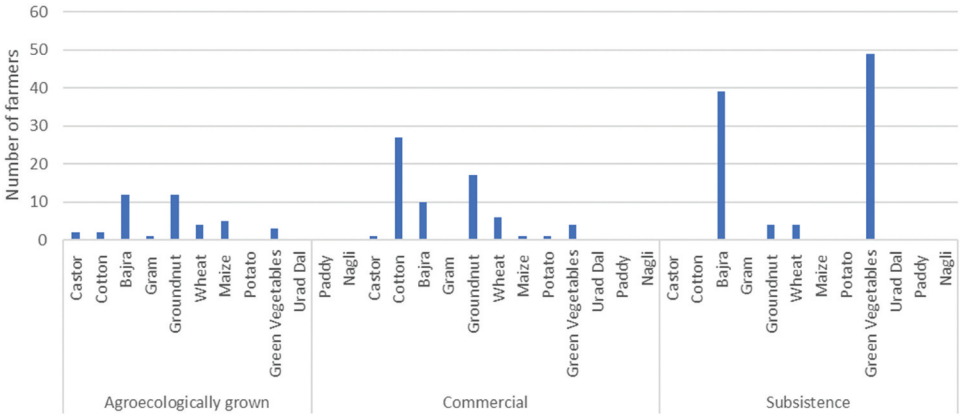

Figure 6. Crop choices in Bhavnagar.

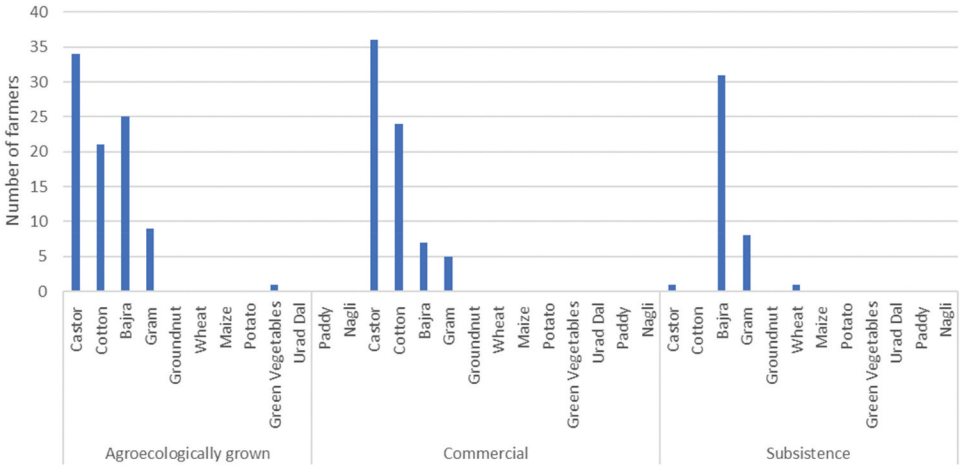

Figure 7. Crop choices in Kutch.

(Figure 5) and Kutch districts (Figure 6), where we had been able to meet the maximum number of farmers, in terms of their cropping systems illustrates this.

The farmers interviewed in these two districts are both demographically different – the farmers identified in Kutch are all men, while there is a significant proportion of women farmers in Bhavnagar. Nevertheless, these two regions had been identified by key-informants as the hubs of the agroecology movement in the state, given the presence of various formal and informal institutions in these regions.

Most farmers grow groundnut and bajra along with wheat, maize, and green vegetables through agroecology-based practices in Bhavnagar. In Kutch, castor, cotton, and Bajra are the main crops. A closer look though reveals a greater prevalence of subsistence-based agroecology in Bhavnagar with the

prevalence of Farmer Producer Organisations (FPOs) in Kutch (Adhesar and Upaj) meant greater foray into the commercial crops like castor and cotton. The greater demand for organic food products like groundnut oil might drive higher production of groundnut through agroecological practices. The comparison clearly highlights the importance of marketing support in deciding, which crops are chosen for agroecological production.

In terms of assets and irrigation use, 52% farmers were exclusively rainfed, manual flooding was the most common irrigation practice. Even though the number of households employing family labor was as high as 239, on average, seven hired laborers were used for agricultural purposes every season. In over 90% of households' women participate in agriculture contributing physical labor. Despite the recent thrust on indigenous cows, buffaloes were the most common livestock (nearly 50% of the livestock population) with an average herd size of 2.8. The livestock distribution has implications for the transition to natural farming that is focused on indigenous cows and concoctions made from its dung and urine in Gujarat.

All farmers use some form of organic inputs, and 47% of them acquired some form of bio-fertilizers from the market. When we look at the use of bio-inputs, across all the districts cow dung, is applied by farmers most commonly. This is followed by people using *Jivamrut*, *Beejamrut*, and *Achadana*, while other inputs are insignificant. About 70% of the farmers reported saving seeds. While mulching as "Achadana" was reported by farmers as a minor practice, 65% of the farmers stated that they are using their farm residue as manure or mulch. Evidence from the ground indicated that despite the large thrust to introduce natural farming through the four principles of ZBNF, its actual use on the ground was significantly lower. 78% of the farmers, reported practicing sustainable agriculture on their entire farms. While, stopping the use of chemical inputs is the necessary criterion for a farming system to be classified agroecological, 31% of the farmers are still partially using chemical fertilizers in their fields. Unsurprisingly, 29% of the farmers were also partially applying chemical pesticides in their fields given the prevalence of cash crops in Gujarat. The proportion of such farmers was highest in Mehsana and Sabarkantha, where 80–90% of the interviewed farmers are using chemical pesticides. Even in Dang (the "100% organic district") about 30% of the farmers reported using chemical pesticides. This goes on to show many farmers who report to

be practicing agroecological practices completely, rely on partial use of chemical inputs, indicating how often agroecological practices are defined by farmers even in terms of partial use of chemical inputs. As expected, the proportion of farmers using chemical inputs is more for transitioning farmers compared to the farmers more experienced in agroecological practices

Table 3. Synthetic input use among different categories of farmers.

	Fertilizer use (% of farmers)		Pesticide use (% of farmers)	
Category	None	Partial	None	Partial
Pioneer	97.4	2.6	97.4	2.6
Transitioned	72.8	27.2	73.7	26.3
Transitioning	57.0	43.0	60.7	39.3

(Table 3). Therefore, it can be expected that farmers with more time to implement the practices, they will be shifting to completely organic inputs in line with agroecological principles.

Significantly, 98% of the farmers cited that the overall fertilizer cost had decreased because of shifting to agroecological practices. It is not surprising that many cited cost reductions as a motivation for shifting to agroecological practices. The other motivation to shift to agroecological farming were health benefits which was cited by most of the farmers. Very few cited ecological benefits as the cause for shifting agroecological practices, although 69% of the farmers claimed that there had been a reduction in water consumption after shifting to agroecological practices. 100% of the farmers also claimed that their soil biodiversity, especially earthworm populations have increased after adapting agroecological practices in their fields. There is thus a diverse understanding of sustainable practices with farmers adapting to agroecological practices and preferring to experiment, even innovate, before they convert their lands. Unfortunately, these insights do not seem to find space in the state led extension systems that are target driven.

Though markets seem to play an important role in deciding the organic crops, the profitability of organic products had not been identified by many farmers as a motivating factor. In fact, while 95% farmers sell at least some of their organic products in the market, only 36% reported receiving a premium price from the market. Only 4% of them reported being involved in value addition to their products. While 70% of the respondents indicated being associated with an FPO, few were into value addition or dealing with organic products.

Towards an Agroecology Learning Alliance in Gujarat

Our intervention within the agricultural knowledge and innovation system in Gujarat as an "innovation broker" (Kilelu et al. 2011; Winch and Courtney 2007) presents interesting paradoxes and pathways. The political will at the highest level to endorse natural farming has however not been matched with a commitment to agroecology as a science, movement and practice. A target driven approach to become the number one state in natural farming has revealed a few fault lines in the state of Gujarat. These include the underdeveloped capacity of the innovation system to

foster collaboration toward a better understanding of both the science of natural farming in different agronomies and situation specific leads on bio-inputs and even comparison of sustainable agricultural practices. There is a danger of a pro-active state promoting a popular, albeit limited, variant of agroecology – natural farming, instead of acknowledging the diversity of already existing agroecological and sustainable agricultural practices. Replacing the certainty of Green Revolution with the certainty of natural farming as a panacea reduces the complexities of "farming as performance" (Glover 2018). Specifically, the gender dimension of agroecology has found little attention in Gujarat's scaling plans and unlike other states there is no investments in the capacities of women community resource persons (CRPs) in a state that has active groups working on women in agriculture.[25]

As argued by Muenster (2018) the politics of alternative agriculture performances lies in their production of alternative realities and newer knowledge.[26] While it is still early years in the ZBNF movement in Gujarat and India it would be a great opportunity for new knowledge where scientists and farmers and civil society organsiations are involved in joint inquiry seeking to solve many a riddle on soil sciences, akin to opportunities that have been explored, for example in the System of Rice Intensification (SRI) (Kassam, Stoop, and Uphoff 2011).

Natural farming, and more broadly agroecology, needs to emphasize principles than particular practices, and leave space for farmer adaptation and experimentation. Behavioural changes at farm, farmer and system levels need investment of both time and resources and would therefore require a systemically managed transition as indicated in Figure 8, involving multiple stakeholders in the agri-food system.

The survey of farmers in Gujarat has revealed that the intent to move toward sustainable farms and safe food for consumers is a gradual process, and therefore farmers reinvent the practices through collective experimentation while questioning existing practices.

This disconnect of state agencies and research establishments with CSOs working on agroecology is an unfortunate feature of distrust of CSOs by state agencies in Gujarat that is not conducive for developing natural farming as a movement. As newer actors like Amul, the iconic brand of the dairy cooperatives in India, foray into organic farming and initiatives to promote new cooperatives of organic produce are planned there is a need for greater dialogue amongst dissimilar actors that can enable these conversations.[27]

Innovation platforms such as newer learning alliances (Lundy, Veronica Gottret, and Ashby 2005) and their role in rooting systems thinking approaches in development planning have not been tried out enough in the Indian context (Prasad 2016). In the form of facilitated meetings such as the workshop by IRMA on rural transformation through agroecology and capacity

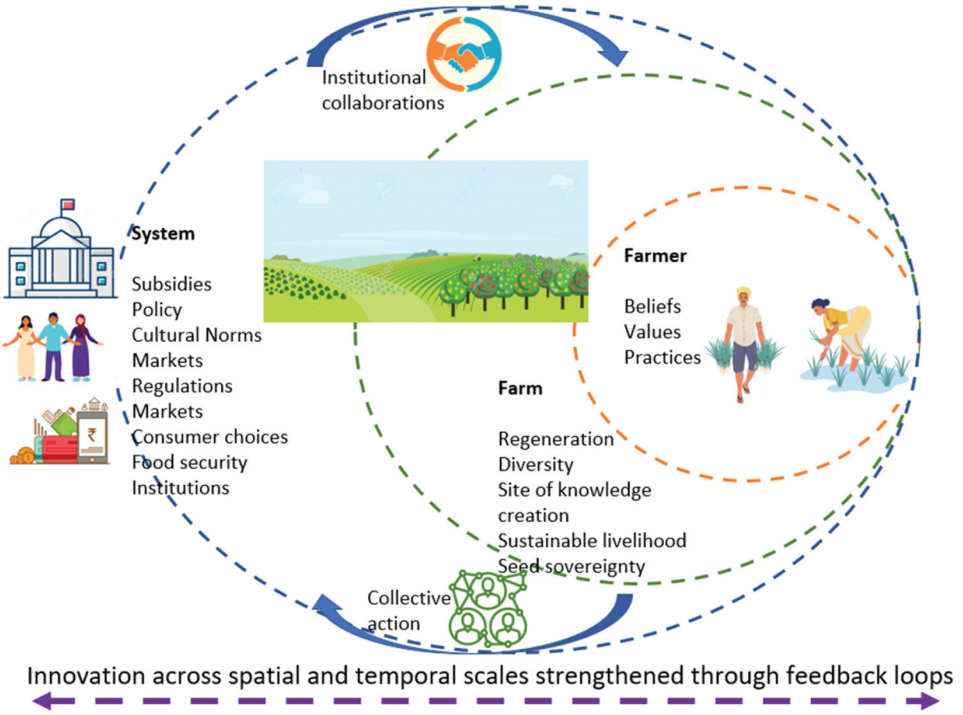

Figure 8. Sustainable transition in Indian agriculture will require a shift at multiple levels (compiled by authors).

building on systems thinking has helped bridge some of these gaps with some interesting institutional innovations. One such was the survey itself that brought ground level innovations at Lokbharti to the larger ecosystem and an ongoing training of women farmers facilitated by the Agha Khan Rural Support Program (AKRSP) and WGWLO with the organic university.[28]

There is a role for the academia in characterizing and understanding these socio-political shifts that can offer lessons for transition scholars on rethinking "development" and "innovation" beyond the Global North highlighting the need to decolonize knowledge systems and pluralize alternatives and responses (Ghosh et al. 2021; Hebinck et al. 2021). The mapping and recognition of the politics of knowledge in sustainability transitions studies encourages scholars to be cognizant of the potential for research and participatory methods in contributing to empowering and building more inclusive knowledge systems. Empowered social movements and informal governance spaces can create opportunities for leveraging the latent knowledge of communities and negotiating learning and action toward capacity building (Eksvärd 2010; Sarabia, Peris, and Segura 2021). Definitional issues on what constitutes natural farming and whether it needs to be seen in opposition to organic farming[29] are not just an academic issue as it does create confusion at the ground level.

When the survey results were shared with the CSOs involved in promotion of agroecology and a few Government agencies through a stakeholder workshop in September 2022 both for feedback to identify missing links and to explore opportunities for strengthening the learning alliance. Many organizations were involved in this exercise with the academia to reflect on the results, and institutionalizing learning and participation within the innovation system. The exercise created joint demand for learning on issues such as role of women and exploring the nature of agroecology as an umbrella principle, rather than a set of practices in the context of Gujarat, highlighting the need and possibility of successfully managing a sustainable transition toward agroecology through innovation platforms driven toward collective learning.

Notes

1. See Rajit Sengupta, 2023. "3,026 people, 2 million ha crops: How 314 days of extreme weather events affected India in 2022" https://www.downtoearth.org.in/news/natural-disasters/3–026-people-2-million-ha-crops-how-314-days-of-extreme-weather-events-affected-india-in-2022–87181 and https://www.downtoearth.org.in/news/climate-change/extreme-weather-2023-india-saw-a-disaster-nearly-every-day-from-january-september-93024. Also Shagun, Vivek Mishra. April 2023. "Food security: Climate change is affecting the seeds that India depends on" https://www.downtoearth.org.in/news/agriculture/food-security-climate-change-is-affecting-the-seeds-that-india-depends-on-88625. This and other articles accessed were on 26th January 2024.
2. See "Why onion prices have crashed in Lasalgaon wholesale market" https://indianexpress.com/article/explained/why-onion-prices-have-crashed-in-lasalgaon-wholesale-market-8470045.
3. For more details See https://blogs.worldbank.org/endpovertyinsouthasia/india-seeks-arrest-its-alarming-decline-groundwater and https://www.teriin.org/article/water-crisis-india-worlds-largest-groundwater-user.
4. We however need to qualify issues of access to many journals in developing countries that might suggest that researchers publish in non-scopus indexed articles. Also, research in policy often might come out in other forms as monographs or working papers or policy briefs etc. that are more relevant from an action research point of view.
5. Rural youth across the world have been disenchanted by agriculture and are trying to move to more precarious urban employment, while undervaluing the agricultural skills they have acquired (White 2012).
6. See https://www.thehindu.com/news/national/govt-should-stop-promoting-zero-budget-natural-farming-pending-proof-scientists/article29386358.ece .
7. See https://naturalfarming.niti.gov.in/wider-consultation-with-states/
8. Unstarred question no. 3294 at the Lok Sabha answered on 21st March 2023. Retrieved from https://sansad.in/ls/questions/questions-and-answers
9. For the purposes of this paper we follow the definition and understanding of agroecology by the Food and Agriculture Organisation (FAO) as a science, a set of practices and a social movement https://www.fao.org/agroecology/overview/en
10. Retrieved from https://nfcoalition.in/about/.
11. Unpublished study guided by the authors of a Verghese Kurien Rural Internship study in 2021.

12. Unpublished report by Development Support Centre (DSC), Ahmedabad 2022 (personal communication). The Soil Health Card scheme, launched in February 2015, has distributed over 150 million cards to farmers throughout India with the hope that this would encourage judicious use of fertilizers to improve soil health and ultimately boost stagnating agricultural productivity. There was little to no evidence of farmers using these recommendations and the Government redesigned the card in 2019. https://www.idinsight.org/project/improving-indias-soil-health-card-scheme-and-agricultural-markets/
13. https://indianexpress.com/article/cities/ahmedabad/7-lakh-farmers-in-state-adopted-natural-farming-says-governor-8847407/
14. The blogs https://www.aesanetwork.org/blog-153-managing-sustainable-transitions-ten-guiding-thoughts-to-frame-the-path-ahead/ and https://www.smallfarmincomes.in/post/rooting-for-change-building-networks-for-rural-transformations-through-agroecology-in-gujarat provide more details of the action research initiatives leading to the survey.
15. ATMA is a district level autonomous agency entrusted with dissemination of agricultural technologies in the district. A total of 141,032 farmers were reached in Gujarat in 2020–21 through ATMA. https://pib.gov.in/PressReleasePage.aspx?PRID=1778910#:~:text=Presently%2C%20Scheme%20is%20being%20implemented,5%20UTs%20in%20the%20country.
16. See https://indianexpress.com/article/cities/ahmedabad/pm-modi-natural-farming-farmers-burning-crop-residue-7675909/.
17. In four districts, no women farmers could be identified, and they were less than three in four other districts. While, these disparities do not really represent the actual picture of the districts, they are indicative of which farmers are most visible to the organizations as agroecology-based practitioners.
18. Their participation was part of a broader initiative to motivate and involve rural youth in sustainable agriculture https://www.smallfarmincomes.in/post/verghese-kurien-rural-internships-creating-pathways-for-empathy-and-empowerment
19. https://www.smallfarmincomes.in/post/grounded-and-practical-an-alternative-vision-for-agri-education-at-lokbharti
20. See https://en.gaonconnection.com/natural-farming-gujarat-governor-acharya-devvrat-narendra-modi-farmers-organic-chemical-cow-global-warming/ for his transition to chemical farming and meeting with Palekar. On the controversy around his appointment as Vice Chancellor to the Gujarat Vidyapith in October 2022 that led to trustees resignations see https://www.indiatoday.in/india/story/9-trustees-resign-after-governor-made-gujarat-vidyapith-chancellor-2286536–2022-10-17
21. The first effort of the government was to establish the Gujarat Organic Agriculture University (now known as Gujarat Organic and Natural Farming University) in 2017. It was later followed by introduction of a MSc course in Natural Farming course across the State Agriculture Universities and more recently a PhD in Natural Farming from the Gujarat University.
22. https://timesofindia.indiatimes.com/city/ahmedabad/gujarat-has-taken-up-natural-farming-says-cm-bhupendra-patel/articleshow/94685540.cms
23. See https://www.indiaspend.com/explainers/what-is-natural-farming-827994 for a good overview of the various schemes in recent times and for the difference between organic and natural farming.
24. https://timesofindia.indiatimes.com/city/ahmedabad/gujarat-farmers-to-get-rs-900-per-family-to-rear-native-cows/articleshow/76648995.cms

25. The Working Group of Women for Land Ownership (WGWLO) is an active group of organizations and one of them ANANDI has been involved In a policy paper on empowering women in agroecology through collectives https://www.undp.org/india/publications/empowering-women-agriculture-closing-gender-gap-through-mahila-kisan-sashaktikaran-pariyojana
26. A review of articles on natural farming and ZBNF indicates significant scientific research coming from the states of Andhra Pradesh and Himachal Pradesh but very little from Gujarat.
27. See https://indianexpress.com/article/business/amul-nafed-promoters-cooperative-society-for-organic-products-8385977/ for more details
28. See https://www.smallfarmincomes.in/post/missing-neither-the-forest-nor-the-trees-co-creating-knowledge-for-sustainable-food-systems for more details.
29. For Palekar's opposition to organic farming see https://timesofindia.indiatimes.com/city/nagpur/organic-farming-will-take-india-the-sri-lanka-way-palekar/articleshow/93080408.cms

Acknowledgments

The authors would like to thank the National Coalition for Natural Farming Gujarat chapter and all its constituent members for their support in conducting the survey and the participants of the workshop where the results were shared for their useful suggestions and comments. We thank Lokbharti for facilitating the participation of six interns for the study and Kapil Shah for his critical comments on the survey design. The survey and workshops were supported by the Living Farm Incomes project at the Institute of Rural Management Anand supported by the Ford Foundation. Usual disclaimers apply.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The work was supported by the Ford Foundation [132843].

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