

RRI's Commitment to Care and Vulnerability of Agrarian Systems: The 'Problem' of Rice Straw Burning in India

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This paper employs RRI's mandate of 'commitment to care' to understand the 'problem' of rice straw burning in India and the possible ways of engaging with it. Straw burning is often framed as a linear technology or policy deficit 'problem' in need of an immediate and quick fix. Interventions and solutions emerging from such framings have so far remained ineffective. The 'commitment to care' approach enables us to situate the current practices of straw burning in a complex web of relationalities, dependencies, vulnerabilities, and affect. By doing so, the 'problem' of straw burning is rearticulated and redefined as a cumulative effect of multiple interventions, transformations, and contradictions that led to the shaping of modern agricultural systems in India. This re-articulation demands for a rethinking of engagement, remedies and responsibilities in ways that move beyond the individualization of blame and action.

Keywords: Agriculture, responsible research and innovation, vulnerability, commitment to care, straw burning

The burning of rice straw by farmers in the northern states of India in the months of October and November has emerged as a serious concern over the past few years. The severe detrimental impacts of agri-residue burning on air quality and

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health of people in the nearby states including the capital city of Delhi has received wider coverage in national as well as international media (Kazmin & Singh, 2017; Mukerjee, 2016). Multiple solutions have been proposed and implemented. These range from strict legal action in the form of fines and jail time to technological interventions for straw removal and conversion to bioenergy (Berry & Sagi, 2017; Mukerjee, 2016). Despite the wide range of solutions offered over the past few years, the practice of straw burning still continues and has been increasingly adopted by farmers in different regions all over the country. Angry residents are often shown in the news clips complaining about their plight and asking why farmers are not stopping this practice, why farmers are being inconsiderate and uncaring towards people's health and why they are acting as irresponsible.

In this article, we will focus on the practice of straw burning and many questions around it that remain hidden under the narratives of success of techno-economic paradigm such as agricultural modernisation, by taking it to the point of its enactment—the farmer's field. The discussions and questions from the farmer's field are then situated in the scholarly debates around modern agriculture, in order to facilitate a dialogue between the experiences of actors and analysts. In doing so, we employ the plea for 'commitment to care' invoked through the scholarship on Responsible Research and Innovation (RRI) as a conceptual, analytical and empirical tool. The 'commitment to care' approach enables us to unpack not just the current practices (such as straw burning) but also the significance of these practices that often gets hidden by the 'dominant, successful forms of techno-scientific mobilization' (de la Bellacasa, 2015, p. 2). The situating of farmers' practices with the political economy of modern agriculture shows that straw burning is actually one of the unintended consequence of the successful implementation of Green Revolution technologies, left unanticipated and 'uncared' for while developing these innovations. From an RRI point of view, it raises questions of how far should anticipation and reflection go for the governance of technologies that are declared 'successful' during their introduction. We would argue that the 'commitment to care' as an engaged, continuous and practice-oriented approach becomes extremely important for RRI. In cases, such as this, the focus should lie not only on the introduction of a new technology into a system but rather also on subsequent, interconnected, multiple other changes in the entire sociotechnical ensemble of agricultural systems that made the technology work. But, also eventually, led to multiple vulnerabilities resulting in this unanticipated impact.

Our approach to critically engage with modern (GR) agriculture in relation to the practice of straw burning is not an attempt to create a dichotomy between the 'good' of traditional agriculture and the 'bad' of modern agriculture. Traditional agricultural societies in India had their own vulnerabilities as a result of over-reliance on nature (Gupta, 2005) and social order around power structures and hierarchies of caste, class and religion. Modern agriculture, in many ways, disrupted this with the hope of progressive reorganisation. However, it is the inability of modern agriculture to re-stabilise and improve rural life that resulted in new vulnerabilities and forms the core of our analysis.

As we will discuss in detail in the following sections, the ‘problem’ of straw burning is a cumulative effect of multiple vulnerabilities that systemically influence the practice of agriculture. We will look at the problems that lead to the decision to burn straw and the solutions that farmers deem suitable for it. Entangled in the problems and solutions for straw burning are different ontologies of agriculture and the ways in which it is considered to be ‘cared’ for. Although our fieldwork and farmers’ dialogue meeting had a diverse group of farmers (described in detail in following section), for this study they could be broadly classified as those who burn the straw and those who do not. There were excellent examples in our fieldwork where individual farmers have adopted practices of in-situ straw management and organic farming. However, these are very recent and marginal trends in Punjab and Haryana where majority of farmers resort to burning of residual straw. This article is about the farmers who burn the straw.

Why Do We Care?

This article is an outcome of a two-year NWO-funded project Responsible Innovation of Biogas (RespInnBio) where a team of Dutch and Indian university researchers initially started a collaboration with the R&D division of an industry to work on developing biogas from agricultural residue. The plan was to engage with multiple stakeholders. Scientists working on different technologies, multiple government departments who have a role to play in developing supportive policies for bioenergy, industry and local entrepreneurs who would develop biogas and a sustainable business model for it and farmers who are the main agent for the production and supply of raw material or feedstock for the biogas plants. RRI demands a ‘commitment to care for the future through responsive stewardship of science and technology in the present’ (Owen et al., 2013, p. 36). This means that as researchers working on the project ‘RespInnBio’ in India, we need to commit to care for the futures which our project might help in shaping in multiple ways. For RRI, it generally means engaging with future (un)intended consequences of technology through anticipation, reflection, inclusion and responsiveness (Owen et al., 2013). A ‘commitment to care’ rather than predict and control the future in RRI points towards the acknowledgement of vulnerability of the technological cultures we live in, defined by uncertainty, ambiguity and fluidity (Bijker, 2006; Hommels, Mesman, & Bijker, 2014). As a result, requiring care as a response to vulnerabilities would entail an ethico-political obligation to be attentive to the most vulnerable and marginalised (de la Bellacasa, 2011). In order ‘to care’, RRI has to take local vulnerabilities and needs into account (Di Giulio, Groves, Monteiro, & Taddei, 2016) and pay attention to processes of exclusion and dominance that render innovations useless for them. Thus, without engaging with the vulnerabilities of agricultural systems and farmers who practice straw burning, RespInnBio seemed to be a far-fetched preposition.

Understanding the problem of straw burning by engaging with vulnerabilities of agricultural systems through RRI’s ‘commitment to care’ would mean paying

attention to a diversity of relationalities between humans and non-humans such as soil (de la Bellacasa, 2015), micro-organisms (Schrader, 2015), machines, livestock and knowledge systems. Caring for these relationships is not only essential for the sustenance of agricultural systems but is also crucial to engage with the issue of straw burning. A care approach to vulnerabilities encourages a rethinking of these relationalities beyond the economic, technocratic and productionist paradigms (de la Bellacasa, 2015). For RRI, this emphasises paying attention to the social roles of agriculture (Thompson, 1986) along with its economic roles and culture of agriculture along with its science.

The Site of 'Caring'

Care is a politically charged practice that requires a continuous practical engagement and everyday material doing (de la Bellacasa, 2011). As an interventionist approach, 'commitment to care' is thus an open invitation for RRI practitioners to play an active and engaged role in collectively shaping the world and things they study and to be accountable to their becoming (Martin, Myers, & Viseu, 2015). For our two-year RRI project, engaging with farmers was not the primary activity, rather it was one among the many meetings that we had to carry out in a very limited span of time. Over the course of next one year and multiple interviews with different actors, it became clear that along with many technological, supply chain and market challenges, the burning of straw by the farmers is one of the biggest challenge for RespInnBio. No one we interviewed seems to have a clear and comprehensive idea, besides few wild guesses, about why do the farmers burn the straw even when they are warned of punitive and legal action.

Despite being very aware of the limitation of resources and time we had, it was decided that we should jump the wagon from thinking about how to develop a responsible industrial biogas to care about farmers' vulnerabilities. The site and mode of engagement, thus, becomes crucial. The biggest challenge in front of us as 'outsiders' in a rural setting was to meet farmers who were burning their straw. This challenge was amplified multiple times because of the blame, criticism and ridicule for the farmers circulating through media reports. Before arriving at the format of farmers' day event, we experimented with a number of other approaches to understand farmers' perspective. First, through the connection of the local non-governmental organisation Kheti Virasat Mission (KVM), we interviewed farmers who were using family-based biogas plants and doing in-situ management of straw through mulching. We got a second-hand understanding of farmers who burned the straw from the narrative of farmers who did not. As a next stop, we got in touch with a local agriculture science centre (Krishi Vigyan Kendra [KVK])¹ in Punjab, which is a government agriculture extension unit, to organise a meeting with the local farmers. This meeting consisted of a mixed group of twenty farmers (all male) who met with us in the presence of local government authority in the KVK conference room. Unfortunately, due to their one-to-one connection with the local authorities, most farmers shied away from openly discussing the reasons for choosing burning

as a method of straw management. The language of communication, where our questions in English were translated by the KVK officer into Punjabi and vice versa also became a major impediment in free exchange of ideas and a lot of information got mixed-up and lost in subsequent simplifications and translations made by the officer. By the end of the meeting, we were really not sure if it was the response of the farmer or the KVK officer. However, this exercise made us aware that besides the challenge of managing excess amounts of straw, farmers were extremely worried and concerned about the air pollution in Delhi and urban citizens' demand of accountability from them. Thus, as a third attempt, we asked KVM director to invite farmers who burn the straw along with those who do not as a part of a three-day seminar where scientists, social scientists, NGOs and local entrepreneurs would gather to discuss the issues of straw burning in an informal, open format. To this, he laughingly said 'farmers are not going to come to a seminar and that too in a fancy hotel'. What he was implying was that both the format and the space are not comfortable for farmers to talk about agriculture and its challenges openly. And it is only by organising a farmers' dialogue in a farmer's field can we get a better picture of what they think. For a free flow of ideas and discussion, farmers had to outnumber others² and the medium of communication has to be a local language that could be translated in English in hushed tones without interrupting the flow of discussion. Utmost care has to be taken to not individualise those who burn the straw in order to enable them to speak openly about their vulnerabilities and challenges. These considerations resulted in the farmers' dialogue format where more than 100 farmers gathered for a whole day of discussion. The event took place in a section of an organic farmer's field, which was actively chosen to demonstrate the potential of this farming method in engaging with the problem of straw burning. The food served during the event was also organically produced in the same farm and locally prepared.

The event was attended by farmers from Punjab and Haryana along with scientists, social scientists, NGOs and one biogas entrepreneur. Most of the farmers were medium landholders along with few having large and few with small landholdings. All the farmers were between the age group of 20–70 years. There was just one woman farmer who attended the event with her husband. The number of those who burn and those who do not burn the straw was roughly equal. However, those who do not burn the straw were not always organic farmers. Which means, despite practicing chemical farming many farmers reported that they do not burn the straw anymore.³ After a few rounds of informal introductions about who everyone is and what they do, the event gradually transformed into a dialogue between those who burn the straw as a result of multiple vulnerabilities and those who are experimenting with different ways of practicing agriculture without burning the straw (including the organic farmers). Towards the mid of the day, farmers were openly discussing their challenges with a relative ease and exchanging ideas, practices and even phone numbers for a follow-up. There were few who reported that they had tried multiple alternative methods of straw management and have returned back to straw burning because the alternative methods had resulted in damage to their crops in the form

of diseases or low yield. There was hardly any instance where the modernisation of agriculture and the relational transformation of farming and farmer's life was not discussed. The problems of modernisation of agriculture were clearly apparent, but so were the challenges of reverting back to traditional methods.

The rest of the article will focus on the discussion of multiple vulnerabilities that impact farmers' decision to burn the straw.

Vulnerability Due to Scarcity of Time

One of the reasons that farmers gave for burning of straw was that there is a very small time window between the harvesting of paddy and sowing of wheat where farmers have to act fast and clear the fields as soon as possible in order to aim for the desired returns. According to majority of farmers in the meeting, burning the leftover straw on the field thus becomes the easiest, cheapest and most accessible way of getting rid of what they consider as 'waste', as their gaze is set on the next crop cycle. Farmers discussed the disconnect of natural means of rejuvenating the soil and its replacement with technological means which are much faster, the replacement of farm animals who could consume straw with machines and the lack of time with farmers to 'care' about straw. This altogether contributed to a culture of haste where time becomes the most valuable entity and vulnerability of losing time causes them to burn the straw. Majority of times, discussions around straw burning pay little attention to the processes through which this culture of haste has become a central feature of agriculture in Punjab and Haryana.

In 1985, the Government of Punjab appointed an expert committee to look at the problems of agriculture in Punjab (Jodhka, 2006). The Johl Committee report 'expressed concerns about the stagnation of productivity level and deterioration of environment due to the cropping pattern dominated by paddy wheat rotation' (Jodhka, 2006, p. 1532). The operation of paddy-wheat rotation in a continuous, mechanised fashion to draw maximum output points towards the deficiency of time engineered in modern agricultural systems that eventually leads to burning of straw. The culture of haste leaves little consideration for things, such as environmental pollution by straw burning, that do not call for immediate concern (de la Bellacasa, 2015; Nowotny, 1992; Wajcman, 2008).

The history of modernity could be read as a series of technological innovations that have resulted in ever-increasing time compression and independence of social relations of time from space and the body (Virilio, 1995; Wajcman, 2008). The removal of leisure time and leisure activities through either regulations or incentivisation deteriorated the sociocultural activities of labourers and workers in an industrial setting (Adam, 1995; Harvey, 1976). Many technological interventions in agriculture such as irrigation technologies and short life cycle varieties aim to increase productivity per unit time. Growing more crops per year and the promise of more income is an incentivising mechanism through which agriculture could be set in the commercial mode. However, this logic of productivity and yield-oriented

strategies of modern agriculture have worked against the local agricultural practices. Vasavi (1994), while discussing agricultural practices in Karnataka, argues that unlike the focus of modern agriculture on linearity and uniformity, traditional practices of agriculture indicate an elaborately constructed complex based on careful consideration of appropriateness, local context and accommodation for change. The natural means of preparing fields for next sowing season requires periods of breaks from agriculture and leaving the land fallow for rejuvenation for a certain duration of time. The leisure time and sociocultural activities in agricultural societies are neatly fitted during these periods of breaks from agriculture. These activities would range from engaging in different festivals to marriages of children (Vasavi, 1994). The stress of working with uncertainty and unpredictability of nature is taken off during this period of sociocultural engagement and farmers' rejuvenate along with the land for a new season of agricultural activities.

There were no discussions of festivals, songs or social celebrations in agriculture in the farmers' dialogue. In the case of Punjab and few other northern states, the technological intervention and incentives of more and more production and economic returns have set up a crop rotation cycle where there is no more a possibility of leaving the land fallow or taking a break from farming.

Vulnerability from Technological Treadmill

Farmers discussed how after the successful incorporation of combine harvesters in the farming practices the incidences of straw burning have increased. The use of combine harvester has completely transformed the agriculture and harvesting in Punjab and Haryana (Jodhka, 2012). It replaced labour, farm animals and threshers to decrease the cost and time of cultivation (Rahman, 2015). The combine harvester itself is a very expensive piece of farm machinery that required farmers to look for government subsidies, agricultural loans and informal credits.

Yet many of the farmers in the farmers' dialogue event demanded for technological solutions to the problem of straw burning. The demand for newer technology has become a pattern in the practice of modern agriculture, especially in regions of northern India (Kumar, 2016), to the extent that it has become an indirect measure of 'care' from the government and scientific agencies. A professor working on agricultural technologies in Punjab mentioned that 'it is a general belief among farmers that more technological inputs would invariably lead to more produce and output' (personal communication, 28 July 2016). The trust on technology has resulted in over-mechanisation as one of the leading cause of rising costs of production, especially in Punjab (Jodhka, 2012; Singh, 2000). The state has highest number of Tube wells, tractors and combine harvesters (Singh, 2000). The over-mechanisation often leads to low-input use efficiency (Singh, 2000).

The Happy Seeder was discussed by the farmers as the next 'it' technology for the problem of straw burning (Sidhu et al., 2015; Singh, Kang, Kaur, & Goel, 2013). Few farmers from Haryana suggested that their whole village has been using Happy Seeder and it has proved to be a very useful technology in relation to the

issue of straw burning. To this, many farmers responded that Happy Seeder has its own problems. First, it is very expensive and runs on diesel. To bring it to common use, it is essential that the government either provides subsidies on the machine as well as diesel or it makes the machine available through policy initiatives involving KVKs. Second, as the Happy Seeder puts the straw back to the soil, there are issues of water retention causing salinity of the soil as well as development of fungal diseases. Third, in order to use the Happy Seeder for sowing, the straw needs to be evenly distributed in the field; this again demands more technologies or labour. Further additional innovations and technological add-ons are needed to solve the problems that Happy Seeder creates. Straw Management System (SMS) is one such machine that could do the job of distributing all the straw evenly in the field.

The anticipated, unending demand for new machinery puts farmers on a technological treadmill that constantly contributes to distress related to acquiring resources in the form of either subsidies and loans or more cash. The increasing cost of production has also contributed to decrease in the number of cultivators. As a result, many small and marginal farmers are unable to bear the cost of inputs, and they are forced to quit cultivation themselves and lease their land to medium farmers who have the desired resources (Singh, 2000).

Vulnerability from Market-centric Approach to Farming

The current farming practices in Punjab and Haryana are completely geared to the market of paddy and wheat. The government support policies that once aimed at 'caring' for farmers through market mechanisms have created severe distresses in the form of livelihood choices and natural resource depletion. Farmers questioned the suitability of growing paddy in Punjab. One of the farmer said

Farmers have many other problems to deal with than straw burning. Most of the people present here are not consuming rice but sowing it. In the attempt to produce more and more we have stopped taking the requirement, need and quality of the field into account. How did we end up doing rice cultivation when we do not even consume it? I think we got brought into the promise of Green Revolution and destroyed our farming. (Farmer, personal communication, 28 November 2016)

Farmers explained that they are aware that the current agricultural markets are exploitative towards producers and puts huge pressure on the resources as well as the farmers themselves. Despite this awareness, it is extremely difficult for individual farmers to move out of this system without incurring huge losses which sometimes amount to debts and losing lives (Farmers' Dialogue, 28 November 2016). One farmer also questioned the ever-deteriorating condition of farmers' vis-à-vis other agents who earn their livelihoods by promoting GR agriculture. He said 'there are scientists, technology companies, seed, fertilisers and farm equipment sellers, all

of them have reached a better place by working with agriculture while it is just us farmers and our conditions that are continuously deteriorating in this model’.

As part of the GR package, many market policies were introduced by the government. This included setting up Minimum Support Price (MSP) and government procurement centres for major GR crops such as rice and wheat. These initiatives were brought in place to prevent exploitation of farmers, especially the small landholders, from local middle man and moneylenders (Jodhka, 2006). Multiple credit and loan mechanisms and farm subsidies were set up for normalising the input costs of machinery, fertilisers and pesticides, electricity and new seeds (Gill, 2010; Gill & Singh, 2006). These policies have proven to be very helpful and supportive for the farmers during the early years of Green Revolution. However, as Jodhka (2006) points out, many factors led to the decline of effectiveness of these support systems, post-economic reforms in the country in the 1990s. These include lethargy of procurement agencies in procuring produce directly from farmers, lack of proper revision for support price from central government, dominance of local middle men, moneylenders and private players in the market space and lack of proper storage facility (Jodhka, 2006). As a result, the situation of increasing expenditure in agriculture and decreasing output prevailed and had put majority of farmers in a state of perpetual debt.⁴

The neglect of local environmental conditions and over-exploitation of resources such as groundwater for irrigation were reported as another stress factors by farmers. Some farmers explained that the market orientation of farming also led to extinction of many traditional varieties of crops that were suitable to be grown in these regions and would provide support to the agricultural ecosystems. Government has also initiated an MSP and support programme for lentils in Punjab. Farmers in our meeting told that due to their dependence on local traders for credit, they are invariably tied to them for selling their produce. Local traders do not seem too enthusiastic to procure anything other than rice and wheat in good price. Government attempts to regulate the market have proven inefficient so far, further adding to the power of private traders. As a result, all efforts for diversification of agriculture, including lentils, have failed.

Vulnerability from ‘Deskilling’ of Farmers

The practice of straw burning, as many farmers recall from their memory, was first supported and promoted by KVKs and agricultural extension scientists. Farmers gave multiple explanations in support of straw burning ranging from ‘they burn the straw based on scientific knowledge that the potash from the ashes enriches the soils’ to ‘similar age-old practices of traditional agriculture in north-eastern states of India’.⁵ Farmers expressed their dependence on state authorities not only for the delivery of technology but also for the appropriate knowledge that needs to be used to effectively manage straw and prevent burning. In the absence of the ‘right’ solution proposed by KVKs, farmers explained, they are left with no choices but to burn.

Agriculture is a skill-based means for sustaining livelihoods. There are multiple factors, including experience, education, sociocultural beliefs, proximity and access to resources and networks that contribute to learning and development of agro-ecological skills (Stone, 2007; Vasavi, 2009). This systematic and long-term engagement through observation, discussion and participation in each other's activities eventually gets institutionalised and ingrained in sociocultural practices (Brodt, 2001; Fitzgerald, 1993; Kumbamu & Stone, 2007). Stone (2007, p. 73) argues that farming is a 'performance that changes in response to changing technologies, pest, climate, seeds and agricultural policies', which means that agricultural skilling is not static but a continuous and ongoing process of environmental and social learning (Stone, 2007). This entails that unlike industrial set-up, introduction of mechanisation is not just automation of farm tasks, but rather, a disruption of this learning mechanism and systemic degradation of a farmer's ability to perform, choose and innovate (Stone, 2007).

In the GR model, farmers' knowledge was considered outdated and unfounded on scientific facts (Ellis & Biggs, 2001; Vasavi, 1994). Knowledge and expertise coming from 'trained experts' held more value and farmers grew increasingly disregarding and hesitant to use their own time-tested knowledge and methods (Vasavi, 1994, p. 294). Along with this, different mechanisms of incentivising and rewarding 'good' farmers as those who are good followers and implementers of expert advice rather than innovators and disregarding dissenting farmers further contributed to knowledge de-skilling in terms of trusting, retaining and practicing their own knowledge (Kumar, 2016; Vasavi, 1994).

In the farmers' dialogue, despite the common acceptance that straw burning is hazardous, there was an observable distrust on other forms of in-situ straw management such as mulching. Farmers reported many challenges of executing alternative ways of straw management including lack of time and resources and damages caused by waterlogging and diseases. Although, those who burn the straw were appreciative of those who do not, there was an apparent discomfort and hesitation in adopting their methods. For every farmer who suggested novel ways of managing straw other than burning, there was rigorous questioning from others which culminated in exchange of phone numbers if the proponent was able to establish some trust by justifying his method.

Vulnerability and Deteriorating Social Institutions

Punjab and Haryana are often known as the land of 'progressive agriculturists' (Jodhka, 2006, p. 1531). To a large extent, along with technological and institutional innovations, credit for the success of GR is given to the enterprising farmers who took pride in their agriculture, identified with their land and made farming as a matter of dignity and honour (Gupta, 2005; Jodhka, 2006). Preston and Wickson (2016, p. 50) argue that 'agricultural practices significantly shape both community and personal identity, implicitly expressing deeply held moral convictions'. The

introduction of technological and economic changes might result in disruption of these practices which constitute identity and agency (Di Giulio et al., 2016). Ideally, these disruption must result in new alliances and mechanisms to re-constitute identity and community. However, in case of agriculture in Punjab and Haryana, the process of re-constitution has left gaps and vulnerabilities that does not sustain and support rural community and rural way of life. The loss of identity, moral authority, community and trust is the subtext of the phenomenon of rice straw burning that often goes unrecognised. The government's decision to take legal action against farmers burning straw aggravates this challenge further.

All the farmers we interviewed were strictly against the criminalisation of farmers for straw burning. Farmers said that looking at the distress through which agriculture is going through all over the country, there is a dire need to appreciate and support farming and agriculture rather than blaming farmers for the problems of pollution. The leader of the Kisan union said that

Farmers are very sincere about the problems caused by straw burning and desperately trying to find a solution for it. But they alone cannot do anything. Farmers are being criminalised and put to jail. Is this the way the government and the society is rewarding the people who have taken up the responsibility of ensuring the food security of the nation. (General Secretary of Kisan Union, Mansa, Punjab)

Farmers expressed their deep concerns towards the disinterest of younger generations and women in agriculture and the future of agriculture. Study has shown that this disinterest is registered across the caste and class spectrum (Jodhka, 2012). For the youngsters of the Dalit communities, agriculture symbolises the power and patronage by the locally dominant classes. Thus, they often try to dissociate from traditional agrarian systems for political reasons (Jodhka, 2006).

Several farmers reported that all the young people who get college education often consider agriculture as a demeaning job. The impact of modern education on downgrading of farming as an occupation and devaluing of farming skills of rural youth have been reported in literature (Sharma, 2007; White, 2012). The impact of economic development from agricultural growth in the GR period led to focus of rural population towards modern education (Gill, 1988, 2005). Rather than returning back to village and practice agriculture, many college-educated youngsters from dominant agricultural castes preferred to stay in the city waiting for the appropriate jobs (Jeffrey, 2010). Agriculture and rural life no more appears attractive and neither can they identify with it as an all-encompassing way of life and identity (Lindberg, 2005 in Jodhka [2006]). The disinterest of the younger generations in farming also results in absentee landlords and the culture of renting farmlands contributing to rising rent prices and over-exploitation of agriculture to combat them (Gill, 2005). The vulnerability for burning straw is increased manifolds when the elderly landlords are unable to do manual tasks and the tenants save labour costs to recover rent prices. One elderly farmer responded in a desperate manner saying

we are quite helpless in the present situation! Who doesn't know that burning of the straw is not good but we do not have any choices. We are old and incapable of harvesting ourselves and our youngsters are not interested in doing the farming job. They want to move to the cities and even to foreign countries. The government can find a solution if they want, but they are also looking away. (Farmer, Bahawalpur, Punjab)

A similar response was observed when discussions around agriculture and women in relation to changing gender dynamics and disconnect of agriculture and nutrition were initiated. This shift is majorly observed among women of dominant agricultural castes. One farmer retorted that

Our women do not have any interest in farming these days. They are educated and do not want to get soiled. They cannot tell which farm we have and would not know the basic farming terminologies. They do not visit the farm at all, not even to bring us lunch, which was earlier the case. (Farmer, Bhatinda, Punjab)

The hierarchical organisation of agriculture in rural settings in India based on distinctions of caste, class and gender are very well established (Gupta, 2005; Jodhka, 2012; Vasavi, 2009). However, in that highly hierarchal and inequitable society, agricultural practices provided a common and shared space where cultural prescriptions and social transactions were negotiated (Vasavi, 2009, 1994). The integration of agriculture into the market economy has led to reordering of these cultural norms with double negative effects (Gill, 2005). Although the social customs of caste, dowry and patrilineal land rights are still largely retained, the integration of agriculture to market economy has led to individualisation and deterioration of community support in times of crisis (Padhi, 2009; Shiva, 1991; Vasavi, 2009). The increased burdens of risk resulting from individualisation, lack of adequate support from institution and state, and vacuum created by deterioration of traditional social institutions results in vulnerabilities that contribute to decisions of rice straw burning.

Concluding Discussion

The issue of straw burning is often presented as a singular, disconnected 'problem' in need of an immediate and quick fix. There is an apparent linearity in the ways straw burning is framed as a technology or policy problem, leading to solutions that remain ineffective and inefficient. This article, by engaging with the perspectives of farmers who burn the straw, re-articulates the 'problem' of straw burning as an issue deeply embedded and intricately intertwined in the political economy of contemporary agriculture in India. The re-presentation and re-articulation of the 'problem' of straw burning as a cumulative effect of multiple vulnerabilities of practicing modern agriculture serves two purposes from a 'commitment to care' perspective. First, it reasserts the ethico-political obligation (de la Bellacasa,

2011) of RRI practitioners towards being attentive to the processes of naming and representation that result in the becoming of knowledge and things. In the present case, the re-articulation of straw burning as a collective effect of multiple vulnerabilities highlights the complex relationalities and responsibilities that get hidden in the dominant and linear narratives of success of techno-economic paradigms. The 'commitment to care' also means not just being sympathetic and concerned about neglected things/issues/knowledges but also making an active effort to bring the neglected to the fore. It is well known that agricultural practices are hybrids of traditional and modern knowledge. However, the process of hybridisation is often uneven resulting in gaps and voids that lead to multiple vulnerabilities. This article re-articulates these vulnerabilities in relation to the issue of straw burning in order to make them visible and accountable for decision-makers. The article articulates different vulnerabilities resulting from markets oriented to global consumers rather than local producers, technological treadmill, productionist cycles of rice–wheat rotation, the challenges posed by deskilling of farmers, and the deterioration of sociocultural institutions of community, identity, and local knowledge, that eventually results in the decision to burn the straw.

Second, by situating straw burning in the broader political economy of modern agriculture, a 'commitment to care' enables demands for re-orienting response and responsibility for the 'problem' of straw burning. Reardon, Metcalf, Kenney, and Barad (2015) argue that sometimes it is the imposition of social conventions from the outside, which, despite the ability of vulnerable population to be responsive, limits their actions. 'To care' in such situations would be to look reflexively on the solutions provided to the vulnerable communities and the problems with their articulation that makes them unavailable, unhelpful or inaccessible for vulnerable communities. A focus on the vulnerabilities that farmers encounter in order to access different solutions is a fruitful way of engaging with the question of why they cannot stop this practice. This reflexively opens up the possibilities of intervention and change. For example, when a local entrepreneur started a business on converting rice straw to biogas to solve the problem of straw burning, he did not receive much support from the farmers because availability of fuel for domestic use was not their problem. Once the entrepreneur refocused and re-defined his business in relation to improving soil health by providing organic manure, his venture was acknowledged by farmers as helpful and they started extending their support to his initiative.

Care as practice also draws attention to ethico-political questions in relation to solutions/responses in the context of the problem of straw burning. These include looking critically at 'who cares for whom and what forms of care are prioritised at the expense of others' (de la Bellacasa, 2015, p. 18). A 'commitment of care' in relation to response would mean cultivating practices of continuous engagement-based, context-specific response in place of codified, disengaged and standardised solutions (Barad, 2007; Reardon et al., 2015). The response in the form of legal action and criminal charges against individual farmers found guilty of setting their fields on fire is an example of control centric, codified and disengaged approach.

Not only it disregards multiple vulnerabilities that led to the decision of straw burning by farmers, it also ignores multiple factors that contribute to building of pollution levels and deteriorating air quality in Delhi. By being disengaged to the producers and the causes of production of the problem, legal ban on straw burning became a solution that is neither responsible nor response-able. Among the multiple solutions that are offered in the case of moving out of vulnerabilities leading to straw burning, only few focus on building resilience and capacity for continuous engagement. The efforts by organic farmers in privileging human–ecological relations over anthropocentric, productionist paradigms is one notable example.

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NOTES

1. Agriculture science centres are block-level agriculture extension offices set up during the GR period to provide training to farmers on the scientific methods of doing GR agriculture. There are multiple factors that influence farmers' trust and relationship with KVKs. In our study in Punjab region, we found that majority of farmers we interviewed had trust in the knowledge and information provided by KVKs.
2. Others include social scientists, scientists, biogas entrepreneurs and civil society representatives.
3. This could still be due to the negative image associated to those who burn the straw and farmers were still hesitant during the introductions to openly confirm that they use burning as the method of straw management.
4. Studies have shown that there is a continuous rise in expenditure on crop production and continuous decline in the share of agriculture sector in gross domestic product. Most of the expenditure on crops is found to be on commercial inputs. Studies also found that a majority of the farmers from different regions of Punjab routinely borrowed money from local moneylenders as well as different credit agencies (Gill & Singh 2006; Gill, 2010)
5. Jhum cultivation or slash and burn agriculture or shifting cultivation where whole communities of farmers move to different locations after harvesting and burning the fields. The field is left uncultivated for more than ten years to allow it to naturally rejuvenate. In contemporary situations with rising population and environmental degradation, this practice has also garnered a lot of criticism.

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