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Development of the drought tolerant variety Sahbhagi Dhan: exploring the concepts commons and community building[1]

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Abstract: The concept of commons is often understood to refer to resources shared among a group of people. The resources are typically classified by binaries such as (non-)natural, (non-)rival and (non-)substractable, and the analytical focus is placed on governance for sustainable management. Another approach to the idea of commons emphasises social relations. This concentrates on production resulting from human-human and human-nature interactions. Here, we focus on the latter and investigate the relationship between these two conceptualisations. This is enabled through an empirical study of the development process of a drought-tolerant rice variety, Sahbhagi Dhan, which was the result of a twelve-year long collaboration between the International Rice Research Institute (IRRI)

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and other different Indian institutions. We argue that the concept of the common as a production system can be characterised as an interwoven process of community building involved in the production of resource commons, and we indicate several features of the community-building process that are essential to an understanding of commons as a socially specified system of production.

Keywords: Commons, Sahbhagi Dhan, knowledge production, collective action, governance, India

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1. Introduction

Sahbhagi Dhan (IR74371-70-1-1) is a conventionally bred, drought-tolerant rice variety identified in 2009 by the Central Variety Release Committee (CVRC) and released for cultivation in India, in 2010. It was introduced under direct seeded upland conditions for the states of Odisha and Chhattisgarh as well as Jharkhand and transplanted lowland conditions in the state of Tamil Nadu. The same cultivar has also been released in Bangladesh (as 'BRRI Dhan 56') and in Nepal (as 'Sookha Dhan 3') (Mandal et al. 2009; Dar et al. 2012; Dobermann 2012; Anantha et al. 2016; Basu 2016). Under normal conditions, Sahbhagi Dhan produces 4-5 tonnes per hectare, whereas other varieties yield about 2.5 tonnes; under severe drought conditions, it produces 1–2 tonnes per hectare, while other high-yielding varieties produce nothing at all. With respect to irrigation, it requires two irrigations compared to the four required by other, traditional varieties, such as Sarju 55 and Sambha Mahsuri. The reduced irrigation needs allows farmers to save up to $60 per crop. Sahbhagi Dhan is an early maturing variety that is ready after 105 days, as compared to the usual 120–150 days for other medium and long-duration varieties. This allows farmers to plant the next crop earlier (usually a *rabi* crop such as wheat), which in turn gives them enough time to plant three crops in a year. Moreover, Sahbhagi Dhan produces a higher straw yield, both in terms of quantity and quality (it is also reported that buffaloes like the Sahbhagi Dhan straw more than other straw, which is attributed to its particular softness) (Mandal et al. 2009; Anantha et al. 2016). It is, in short, a successful breed; but it is also rather unusual.

The development and the release for cultivation of Sahbhagi Dhan is actually unique in the Indian context as it did not follow either of the regular trajectories of plant variety development: the public (agricultural research-and-extension) trajectory (such as ICAR-mediated IR or other mega varieties) or private (company-

mediated, market-based trajectory) (such as Bt-cotton varieties) (Basu 2016; Basu et al. Submitted). Instead, this particular variety was developed by a group of scientists, between 1997 and 2009, through a joint research collaboration between the International Rice Research Institute (IRRI) and various other Indian institutions, referred to here as the 'research community'. In this paper, we look at the process through which this variety was developed from the perspective of the ongoing theoretical and practical debates on commons.

Commons can be understood as natural resources that groups of people (communities, user groups) manage for individual and collective benefit. Characteristically, this involves a variety of informal norms and values (social practice) employed for a governance mechanism (Ostrom 1990; Ostrom et al. 1999; Dietz et al. 2003; Berge and van Laerhoven 2011; Anderies and Janssen 2012; Agrawal 2014). This type of analysis has been extended from natural (thus physical, material) resources to knowledge (artificial/constructed, immaterial) resources, or information, the central focus of which revolves around digital forms of knowledge mediated by information and communications technology (ICT) (Hess and Ostrom 2007). The governance mechanisms here are based on sharing and the promotion of open access, such as through networking communities and usage agreements that prevent enclosure (e.g. copyleft, as opposed to copyright).

Focusing on the idea of governance mechanisms, commons may be identified not just (or even primarily) with the resources themselves but also (and as or even more importantly) with the societal arrangements (communities) around the resources. And then, further to this, commons may also be conceptualised in terms of social production. As social products, these are the results of human-human and human-nature interaction with shared aims (cooperation) over a period of time; examples of such include language, knowledge, plant genetic resources and biodiversity. Again, the societal arrangements productive of these themselves may also be regarded as commons (Hardt and Negri 2009; Harvey 2012; Öztürk et al. 2015). Thus, in addition to natural and knowledge commons, one may speak also of *social commons*, an aspect of commons that tends to be neglected (Basu 2016). It is this idea of commons that is emphasized here. The variety produced, Sahbhagi Dhan, may be considered a type of common (a natural-knowledge or material-immaterial hybrid common), as we have argued elsewhere (Basu 2016); similarly, we argue in this paper, the community that produced it, the research community, may also be considered thus, as a social common.

The concept of commons has been taken as a central analytical framework with which to understand the development process of Sahbhagi Dhan here for the following two reasons. First, this variety was developed through a trajectory that was in neither the public nor private realm, with a sense of fuzziness around its development trajectory, of a certain conceptual *terra-nullius* between market and state. Since this is the territory in which commons tend to operate, the Sahbhagi Dhan case seems to invite application of the concept of commons. Second, in previous studies on the social organisation of knowledge production of this particular research community (Basu 2016; Basu et al. Resubmitted), we have argued that

there emerged a complex and extended mode of commons-based peer production (CBPP), as per the software arena where commons are created through the CBPP mode (Benkler 2004, 2006; Benkler and Nissenbaum 2006) – thus, it seemed like a natural progression to push this perspective further and apply it to the development process of Sahbhagi Dhan as a product of the research community. It is this, therefore, which is analysed here, and the following comprises the main research question guiding this paper: how and to what extent the drought tolerant variety Sahbhagi Dhan can be considered as commons?

To address this question, we applied a critical-constructive approach (Vroom et al. 2007; Ruivenkamp et al. 2008). Assuming a critical review of the dominant discourse on commons in terms of (the governance structure of) shared resources (Section 2), an empirical-historical analysis of the development of Sahbhagi Dhan is employed for a constructivist framework for commons. This constructivist aspect involves a re-thinking of the common as a production system. Understood thus as an ongoing process of community building involved in the production of the variety as a resource common, it involves the development of key aspects of commons as production systems, principally the nature of the scientific research community as a discourse producer in the overall context of a commons trajectory.

2. Theoretical framework of commons

The use of 'commons' for natural resources has its roots in European intellectual history, where it referred to shared agricultural fields, grazing lands and forests that were, over a period of several hundred years, enclosed, claimed as private property for private use. In European political texts, the common wealth was the totality of the material riches of the world, such as the air, the water, the soil and the seed, all nature's bounty regarded as the inheritance of humanity as a whole, to be shared together. In this context, on may go back further, to the Roman legal category *res commune*, applied to things common to all to be used and enjoyed by everyone, as opposed to *res publica*, applied to public property managed by the government (Bollier 2002; Hardt and Negri 2009).

In this distinction we see the institution of property governance for the provisioning of public goods, and thence the idea of external or non-localised governance, wherein the management of resources, goods and services is not performed by the community as such. Indeed, the history of land enclosure was one not just of claims by landowners but also of the state withdrawing communal rights. The gradual extension of state and private control – or, the enclosure of the commons through public and private ownership – developed variously through different political regimes to its current expression in neoliberalism, which involves the privatisation of both the public and common, the latter comprising natural and artificial commons – along with social commons (Hardt and Negri 2009; Hardt 2010). This has led to new contradictions and struggles, as the Sahbhagi Dhan development process will illustrate.

2.1. Commons as a governance mechanism of shared resources

Referring to this 'common use of things', a voluminous literature emerged refuting and rebutting in particular the deterministic claim made by Hardin (1968). In his *Tragedy of the Commons*, Hardin had claimed that resource users become stuck in an inexorable tragedy of overuse of resources, from which it followed that sustainable resource use requires either state or private property management (Dietz et al. 2003). Through innumerable case studies on management of fisheries, forests and grazing lands or pastures during the 1980s and 90s, Elinor Ostrom and colleagues refuted this conventional wisdom (Ostrom 1990; Ostrom et al. 1999), showing that user groups do devise collective ways to manage sustainably common pool resources for individual and collective benefits. In fact, this *self-organized management of resources* was found to operate more efficiently than any externally imposed governance and actually advocated *for* long-term sustainability. Tracing the evolution of institutions for collective action and extrapolating thus the design principles of long-lived commons, Ostrom identified *trust*, *reciprocity*, and *communication* as three key building blocks for collective action (Araral 2014). As a limiting factor, the case studies Ostrom cited involved a few hundred or so actors; anything much larger, she argued, would *require a nested structure of decision making*, because direct negotiation between all individual would be impossible (Harvey 2012).

Elinor Ostrom and the Bloomington School of Institutional Analysis and International Association for the Study of the Commons (IASC), with which she was associated, remain the dominant school of thought in studies of the commons, and this school probably is most relevant for small-scale, locally governed commons, with a relevance to the study of large-scale (national, regional and global) commons contested (Harvey 2012; Basu 2014). Nevertheless, along with her colleague Charlotte Hess, Ostrom did succeed in extending the commons debate to knowledge, approaching knowledge as a complex ecosystem that operates as a common – a shared resource that is subject to social dilemmas (Hess and Ostrom 2007). The focus here was on the ready availability of digital forms of knowledge and associated possibilities to store, access and share it as a common.

The connection between knowledge and commons may be made through identifying typical problems associated with natural resource commons, such as congestion, overharvesting, pollution and inequities, which also apply to knowledge. Then, effective alternatives (community-based, non-private, non-state), in line with those of natural commons (involving social rules, appropriate property rights and management structures), solutions are proposed. Thus, the commons metaphor is applied to social practice around knowledge. It is in this context that the present work proceeds, discussing the creation of depositories of knowledge through the organised, voluntary contributions of scholars (the research community, itself a social common), the problems that such knowledge commons might face (such as free-riding or disappearing assets), and the protection of knowledge commons from enclosure and commodification (in the form of intellectual

property legislation, patenting, licensing and overpricing) (Bollier 2007; Hess and Ostrom 2007; Kranich 2007; Crispin 2008).

At this point, it is important to note the nature of knowledge and its complex and multi-layered qualities of non-rivalry and non-excludability. Unlike natural commons – which are both rival and excludable (only one person can use any one item or portion at a time and in so doing they use it up, it is consumed) and characterised by scarcity (they can be replenished but there are limits to this, such that consumption/destruction may overtake production/creation) – knowledge commons are characterised by abundance (they are non-rival and non-excludable and thus, in principle, not scarce, so not impelling competition and compelling governance). This abundance of knowledge commons has been celebrated through alternative models of knowledge production, such as CBPP (Benkler 2006; Benkler and Nissenbaum 2006), and embodied in the free software movement. The CBPP model showed the power of networked, open collaboration and non-material incentives to produce better quality products (mainly software).

Nevertheless, abundance does not necessarily imply access, and the interests of private gain in particular motivate for the enclosure of knowledge commons. Emphasising governance mechanisms based on sharing and the promotion of open access, knowledge commons are typically pitted against the pervasive intellectual property rights (IPR) regime and its creation of what has been dubbed the *tragedy of the anti-commons*, in which a plurality of right-holders effectively prevents socially desirable outcomes (e.g. competitive technology patenting creates impediments for innovation) (Heller and Eisenberg 1998). In the contemporary context, the issue of knowledge commons is also related to the change towards a knowledge intensive society and the science institution as knowledge producer, with technology creation practices similar to (and increasingly together with) private enterprise. These practices are not only limited to the science institutions but extend also to the traditional knowledge held by local (e.g. farming) communities, which is also 'captured' (such as through plant breeding leading to DNA patents and then the marketing of the seed products and subsequent displacement of wild varieties and traditional practices).

2.2. Critique of commons as governance mechanism of shared resources

The dominant school of thought on commons associated with Ostrom, of commons as objects governed by a certain type of mechanism, may be counted as problematic for reasons other than that of size (the maximum number of people in a community). Four such are listed here: 1) natural and knowledge commons are treated separately, but products may combine natural and knowledge resources – such as in the case presented here, of a plant variety (Sahbhagi Dhan) that incorporates both natural resource (the plant variety itself) and the trait inscribed into it (the informational component, drought-tolerance); 2) commons operate in a conceptual *terra nullius* between state and market (Caffentzis 2008), with the continuous struggle to get commons recognised by the state

(Hess 2008) – whereas commons cannot be demarcated by the state, as we will show in this paper, so they go beyond the state-market binary; 3) knowledge commons are often linked to techno-scientific academic knowledge (Hess and Ostrom 2007) – while indigenous (farmer's) knowledge may coexist with the scientific, such as in a commons-based knowledge system (as we show for the Sahbhagi Dhan case), implying that indigenous knowledge is not necessarily less important; and 4) the dominant school of thought on commons starts from the notion of a 'tragedy' related to governance – while perspectives on commons may go beyond the management approach, particularly in the context of knowledge intensive products (such as a plant variety that contains both knowledge and natural resource commons). Therefore, in the following (sub-) section, we elaborate the approach to *commons* that emphasises social relations and particularly refers to the production process of commons, or commons-based production systems.

2.3. Production of commons

Approaching commons as constructions, as a social production processes, the production and product become inseparable from each other (Hardt and Negri 2009). Historically, mankind has always organised valuable resources, such as plant genetic resources (PGR), through collective action, and indeed, it has been argued that the default mode of economic organisation is commons based (Bollier 2002; Ruivenkamp 2017). In the United States, commons has most often referred to shared spaces that allow for free speech and the democratic process, which provides the focus for Benkler's CBPP, a story of digital inter-operability, open science, collaborations and scholarly networks, voluntary associations and collective actions. This US-type common underscores the importance of shared spaces and shared knowledge in fostering viable democratic societies. There are many different ways through which commons evolve or come into being, but they all involve this sense of sharing and joint ownership (Hess and Ostrom 2007). Since they are neither under the control of government nor under market regulations, they offer a possibility of going beyond the simple dichotomy of exclusive private vs exclusive public (Halewood 2010).

It is difficult to conceive of commons without a particular community. Hollenbach (2002) states that commons are realised in the mutual relationship through a community. However, they are not merely the outcome of a collective action, since the important issue is that of a shared enterprise; we can say that commons and community come into being through that enterprise. Commons can be found in the actions that generate them, so benefit from commons is gained through participating in that action process. The existence of commons is mainly due to the shared actions that develop and sustain them in which people freely engage for a variety of reasons (Deneulin and Townsend 2007). Indigenous knowledge and biological resources are also held and nurtured by different communities, or collective enterprises. Therefore, 'no commons without community'

is an accepted axiom in commons studies (Caffentzis 2008). The study of any commons initiative, then, involves analysis of how inclusive communities with equal access, benefits and control are built and can defend that common. This entails the development of inclusive and representative institutions of production, governance and distribution in a manner that encourages and embraces diversity, difference and dissent (Cheria and Edwin 2011a).

2.4. Community

Given that the issue of community is essential for the conceptualisation of commons as a production system, the next question arising concerns how we conceptualise community, particularly, as in this case, a research community or a knowledge production community. Community has long been defined in terms of its location in physical place (as a spatial unit, or territory) with a homogenous social structure (thus small size) (Wellman and Gulia 1998; Agrawal and Gibson 1999). Clearly, this type of conceptualisation is not very relevant here. We conceptualise research community as a dynamic process (Bromberg 1996), one that is always under construction (Ruiz-Ballesteros and Gálvez-García 2014), in which a group of people (different actors) from different organisations/institutions willingly participate and work together for a common objective and try to develop a particular scientific discourse (Henry and Pinch 2000). Scientific discourse here may be defined as the processes and constituents of investigation and knowledge production, with any one such discourse developed through, typically, the specific (types of) resources that are shared and organisational practices that determine policies, such as the requirements for joining the community, norms regarding its functioning and regular procedures related to research and other activities (Wang et al. 2002).

Research communities are frequently conflated with research networks, but there are significant differences between the two. Research networks are basically created for a particular purpose to achieve a short-term goal with a fluid participation base. A research community, by contrast, emerges over a period of time with a lager intensity of interactions and in which a particular discourse is created. In other words, a research community can be comprised of several networks leading to the creation of particular practices or discourses (Wang et al. 2002; Coe and Bunnell 2003; Richardson 2015). Thus, through an empirical account, such a community will be identified according three criteria: a development process through which it evolves, the creation of particular scientific discourse and the development of policies through which it functions (Wang et al. 2002; Coe and Bunnell 2003).

3. Methodology

At the theoretical level, this research applies a critical-constructive approach (Vroom et al. 2007; Ruivenkamp et al. 2008) to first critically evaluate the commons literature as a way of studying the governance structure of a shared resource

and then suggest a way to understand the production of commons. This constructivist aspect involved in a re-thinking of the common as a production system is substantiated with the study of the development of the drought tolerant rice variety. The empirical part of this research is built upon a historical-timeline analysis of the development of Sahbhagi Dhan and the development of the research community through which the constructive part of commons scholarship is reflected upon.

The Sahbhagi Dhan variety was developed within the framework of a joint research collaboration of two distinct networks composed of several national and international research institutes, universities, transfer-of-technology (TOT) centres, NGOs, state agencies and farmers' groups, and which may be adjudged to comprise a research community. The empirical part of this research is built upon a historical timeline analysis of the development of Sahbhagi Dhan and of the research community. Secondary data on the development was gathered first. This comes from a literature review of a range of sources produced by, through or on the organisations and individuals comprising the community, including research papers, scientific blogs, news-letters, annual reports and technical bulletins.

After this initial data collection, the first author undertook a fieldwork for three to four months (April–July, 2012) to collect primary data from the scientists associated with the development of the variety in several locations in India and also in the Philippines. Scientists were interviewed on their involvement with the research community, the history of the development of Sahbhagi Dhan, details of the organisational structure of the research community and the role of farmers in the Sahbhagi Dhan development. Several rounds of interviews were made with the heads of these organisations to get their views on this project, contributing to a total of 45 in-depth interviews made with the scientists, directors and others. The farmers' group associated with the institute CRURRS, at Hazaribagh, Jharkhand, played a crucial role in the variety development, so this group of farmers was interviewed during another visit in October and December 2012. Information and opinions from around 100 farmers, including women farmers, was informally acquired, and several focused group discussions (FDGs) were also held with them. Another 45 farmers who had worked closely with the development of Sahbhagi Dhan were interviewed in-depth.

This primary (interview, conversational and FDG) data is mainly qualitative, as we are trying to understand the process of the development of a plant variety from a particular theoretical perspective. Theoretical insights that guided the data collection and analysis are taken from an understanding of the commons as production systems, or the production of commons, as elaborated above (2.3). The production of this common is understood from an analysis of the production process of the Sahbhagi Dhan. The historical timeline is constructed from the interviews, the narratives of actors involved, concurrently cross-checking the data with written sources. The central theme of the analysis, following the commons literature, was to investigate the production of a common as an interwoven

process of community building. Community is analysed as a dynamic process in which in which actors with common interest through shared norms or organisational culture creates a particular discourse (Wang et al. 2002; Coe and Bunnell 2003; Richardson 2015).

4. Findings

The research community that developed the variety Sahbhagi Dhan continues to function; it had its origins before the development of this variety and has continued since. It is comprised of mainly scientists with varying disciplinary backgrounds, such as in plant-breeding genetics, biotechnology, entomology, plant pathology, statistics, plant physiology and social sciences. These professionals are affiliated with different institutions, primarily the Indira Gandhi Krishi Vishwavidyalaya (IGKV), Raipur; the Central Rainfed Upland Rice Research Station (CRURRS), Hazaribagh; the Narendra Dev University of Agriculture and Technology (NDUAT), Faizabad; Birsa Agricultural University (BAU), Ranchi; the Central Rice Research Institute (CRRI), Cuttack; Tamil Nadu Agricultural University (TNAU), Coimbatore; the Barwale Foundation (BF), Hyderabad; the University of Agricultural Sciences (UAS), Bangalore; Anand Agricultural University (AAU), Anand; Orissa University of Agriculture and Technology (OUAT), Semiliguda; Maharana Pratap University of Agriculture and Technology (MPUAT), Banswara; Vivekananda Parvatiya Krishi Anusandhan Sansthan (VPKAS), Almora; and Jawaharlal Nehru Krishi Vishwavidyalaya (JNKVV), Rewa in India; and, IRRI, Los Banos, in the Philippines (CGIAR Generation Challenge Programme 2011). These different institutions can be categorised as Indian Council of Agriculture (ICAR) research institutes, state agricultural universities, CGIAR institutes, NGOs and/or transfer-of-technology centres. The research community is built upon two distinct networks, developed according to different research angles: the Upland Rice Shuttle Breeding Network (URSBN) for rainfed upland (formally launched in 2003), and the Drought Breeding Network (DBN) for rainfed lowland (formally launched in 2005).[2]

Taking insights from the literature on community building, the findings are presented in section divided into three parts: first, we recount the historical process of Sahbhagi Dhan development; second, we provide a historical evolution of the research community; third, we detail policies pertaining to the organisation of this research community.

4.1. Development process of Sahbhagi Dhan (development of a scientific discourse)

The name 'Sahbhagi Dhan' comes from the Hindi word '*sahbhagi*', which means 'cooperation', this name being chosen precisely because the variety was devel-

[2] Interview, Interviewee 1, Hazaribagh, IN, 2–4 June, 2012.

oped through the collaborative efforts of several institutions, thus already pointing to a common effort.[3] The development of Sahbhagi Dhan was initiated at IRRI in 1997, by French rice breeder Brigitte Courtois under the Upland Rice Research Consortium (URRC). Headed by IRRI, and partnered by NARS an institution in Indonesia, the Philippines, Thailand and India, URRC was in existence between 1991 and 1999. Courtois had made a cross between two south-east Asian rice varieties, IR5541-04 (South East Asian Indica) and WayRarem (Tropical Japonica), of which the former became the donor for drought tolerance. Then, from her base at an upland rice site in Siniloan, in the Philippines, near IRRI's headquarters in Los Banos, Courtois pedigree selected a new line, IR74371-70-1, for upland rice (Dobermann 2012).

After nearly a year, Gary Atlin joined IRRI as a rice breeder and started testing this line for drought tolerance under two different projects: the Eastern India Farmers Participatory Breeding Project (EFPBP) and the Consortium the Unfavourable Rice Ecosystems (CURE). Initially, when testing this breeding line through the CURE programme, Atlin thought that the new plant type could probably be considered an aerobic rice, a moderately drought-tolerant, input-responsive upland rice that would work well in the upper locations of relatively favourable rainfed environments (Dobermann 2012; Anantha et al. 2016). Upon consistent and promising performance during the initial trials, in 2005, the IR74371-70-1 breeding line was nominated for testing by CRURRS, under the All India Coordinated Rice Improvement Programme (AICRIP) (Mandal et al. 2009).

During several AICRIP trials under rainfed, drought-affected situations between 2005 and 2007, the line showed average yield advantages of 29.2% and 19.1% over the national and regional check varieties, respectively; it also showed yield advantages of 22.8% and 31.4% over the national and regional check varieties under non-stressed conditions. Under drought conditions, the line showed a significantly higher yield than all the checks (in Bhubaneswar, Cuttack and Rewa). During the same period, this breeding line was also tested in the DBN on-station breeding trials, conducted in eight locations over a three-year period (2005–07). In these trials, the line had an average yield advantage under moderate drought conditions of 0.5 t/ha and under severe drought of 1.0 t/ha over, respectively, IR64 and IR36, the two prominent varieties grown in these regions, while the yield advantages over these varieties under irrigated control situations were 0.1 and 0.8 t/ha. The breeding line was thus recommended for release at the AICRIP annual meeting in 2008 (Mandal et al. 2009; Verulkar et al. 2010; Kumar et al. 2012; Anantha et al. 2016).

In the farmer PVS trials, conducted in 2009, this breeding line was preferred by farmers under both irrigated control and drought situations. The seed was distributed to eight farmers in the village of Singrawan, in Hazaribag, for the farmer-managed trials, each being provided with five kilogrammes of the seed

[3] Interview, Interviewee 12, Hazaribagh, IN, 4 June, 2012.

for planting by trial, along with that of current varieties. Because there was no rain for the first 45 days of the season, farmers were not even able to plant in their nurseries. In frustration, four farmers broadcast the Sahbhagi Dhan seeds on their fields anyway, with very little hope of reaping a harvest. Fortunately, a few days after sowing, a little rain fell, helping the seeds to germinate. Eventually, these farmers were able to harvest 1.8 t/ha from these fields, whereas in the adjoining area of around 12 ha, no crop was planted and the land remained fallow (Mandal et al. 2009).

An intensive seed production programme was used to disseminate the Sahbhagi Dhan variety in drought-prone regions of eastern India in collaboration with CRURRS-CRRI, BAU, IGKV, state seed corporations, the National Seeds Corporation, Ltd. (NSC) and various NGOs. The variety was recognised in a meeting of the Central Varietal Release Committee held on 24 October, 2009, and approximately 2.5 tons of breeder seed were made available by the end of the 2009 wet season. Many agencies produced the seed again during the dry (*boro*) season and increased the yield quantity to more than 100 tons before the wet season of 2010. The National Food Security Mission (NFSM) chose Sahbhagi Dhan, along with submergence-tolerant variety Swarna-Sub1, for a large-scale promotion during *kharif* (monsoon) 2010, through their minikits programme. NFSM also planned to promote it in drought-prone areas in Jharkhand, Bihar, Chhattisgarh, Uttar Pradesh and Orissa (Mandal et al. 2009; Dar et al. 2012; Dar et al. 2014; Anantha et al. 2016).

Developing a drought-tolerant variety through breeding is a difficult process because the complex nature of drought requires the combination of several drought-tolerance attributes together with high yield potential under well-watered conditions through selection of one or two morpho-physiological traits (Kumar et al. 2008). Responding to this challenge, the research community created a novel scientific trajectory for Sahbhagi Dhan, in which crosses were made between drought-tolerant donors with high-yielding, drought-susceptible varieties for conducting direct-selection for yield under drought (Kumar et al. 2008). Further, the breeding lines were grown with multi-locational trials in different agro-ecological zones, to control for environmental factors. Finally, as mentioned, the lines were tested in PVS trials in the farmers' fields to include their preferences and to include local variations in soils and landscape.

Looking at the research activities of the development of Sahbhagi Dhan, we observe a range of disciplinary activities. These include field screening (phenotyping), genotyping, screening (for disease and pest resistance), associated breeding activities and, of course, conducting the PVS. In order to perform all these activities, the research community comprised of a high number of breeders and professionals across several disciplines, which continues to be the case. These fall into such categories as plant breeding, genetics, physiology, pathology, entomology, biostatistics and social sciences. Each step of disciplinary input into the breeding activities is essential for the next, so each discipline actually works in a way that is intertwined with others to produce knowledge (here, related to drought

resistance). Summarising, it can be said that there is a new drought research trajectory developed by this research community.

4.2. Development process (historical) of the research community

The history of this research community goes back to the early 1990s, when the Rockefeller Foundation (RF) took the initiative to improve the rice crop with a major focus on drought tolerance. RF developed a three-step approach at that time, picking young scientists from ICAR system before training them at an advanced research lab in the United States and, upon their return, arranging funding for them to continue the advanced level research at their own institute. This led to the formation of the International Rice Biotechnology Network (IRBN) and also the Asian Rice Biotechnology Network (ARBN). Many scientists within the research community originally came through the RF initiative.[4] IRRI is the other institute that was central to the formation of the community. Almost all the scientists in the above-mentioned institutions have been involved in individual collaborations with IRRI, having received from it breeding material and training.[5]

The research community has also been shaped by several projects over the last two decades. Initially, in 1988, there was a project called the Eastern India Rainfed Rice Project (EIRRP), led by IRRI, which was funded by ICAR along with the International Fund for Agricultural Development (IFAD). In 1991, as mentioned (4.1), URRC started working with IRRI as a leading institute with its international partners (from India, Thailand, the Philippines and Indonesia). URRC went through three phases and continued till 1999. The development of the Sahbhagi Dhan variety actually began in this project. Between 1997 and 1999, there was the Eastern India Farmers' Participatory Breeding Project (EIFPBP), which received funding from the International Development Research Centre (IDRC). In 2000, Dr Garry Atlin, now with the BMGF, joined IRRI as an upland breeder. Then, in 2001, the Consortium for Unfavourable Rice Ecosystem (CURE) was established with a special focus on upland and lowland rice conditions. The CURE programme established six working groups on drought, submergence and salinity, with Atlin as the leader for the drought component.[6]

Between, 2000 and 2002, Atlin several times visited the CURE centres at Hazaribagh, Raipur, Faizabad, Bangalore, Cuttack and Coimbatore. It was his idea to create a network among these partners to continue the drought research. In 2002, a meeting at the CRRI was convened by Dr B. N. Singh, the then director of CRRI, to which all the partners were invited, in order to discuss the possibility of establishing a network. In the following year, the URSBN was formally launched, with initial funding from IRRI's core funding. Around 2005,

[4] Interview, Interviewee 3, Bengaluru, IN, 19–23 June, 2012.

[5] Interviews: Interviewee 4, Coimbatore, IN, 25–26 June, 2012; Interview, Interviewee 5, Raipur, IN, 12–13 July, 2012.

[6] Interview, Interviewee 1, Hazaribagh, IN, 2–4 June, 2012.

Atlin suggested the idea of a similar network for rainfed lowland, which became the Drought Breeding Network (DBN). Two meetings were held, at Raipur and Bangalore, but IRRI did not have sufficient funding to support the DBN, so Atlin talked to Dr John O'Toole of RF in Thailand about this. Initially, RF funded DBN, and soon CGIAR's Generation Challenge Programme (GCP) also became involved, which covered financial issues (although the first GCP project was also funded by RF).[7]

This, therefore, may be taken as the point when the research community in its present form finally came into being. URSBN is coordinated by CRURRS from the Indian side, and DBN is coordinated by CRRI. In 2007, RF exited South Asia for Africa. Effectively funded by the GCP, therefore, the URSBN was now dedicated to its work with the DBN. The research community carried out a total of four GCP projects from the first, in 2005, until 2014. URSBN was coordinated by CRURRS from the Indian side, and DBN was coordinated by CRRI (which remains the case).[8] GCP funded the following projects of this community: *Developing and disseminating resilient and productive rice varieties for drought-prone environments in India (G4005.69.01); Detecting and fine-mapping QTLs with major effects on rice yield under drought stress for deployment (marker-aided breeding) (G3007.05); Connecting performance under drought with genotypes through phenotype associations (G4008.05); Dissemination and community of practice for newly developed drought-tolerant QTLs pyramided breeding lines (G4011.04)* (CGIAR Generation Challenge Programme 2011). After GCP funding was ended as the programme was wound down, the community was sustained through research activities funded by the Stress-Tolerant Rice for Africa and South Asia (STRASA) programme, a Bill and Melinda Gates Foundations (BMGF)' initiative.

We see, therefore, that this research community, comprised of two networks (DBN and URSBN), actually evolved over an extended period (some two decades) around various projects (ARBN, IRBN, CURE, URRC, and EIRRP) funded by several different international organisations (RF, GCP, IDRC, BMGF etc.). The community is situated within or as composed from several types of organisation, including international institutions, government bodies, NGOs and farmers' groups. People employed by and working with these come together and share their time and energy, their expertise and their effort within the research community, which exists because of the shared interest in contributing towards drought research. The fact that it has sustained research activities over a prolonged period of time (and continues to do so) and that there are two different networks involved in these endeavours makes this a research community.

[7] For more on GCP, see www.generationcp.org

[8] Interviews: Interviewee 1, Hazaribagh, IN, 2–4 June 2012; Interviewee 2, Hazaribagh, IN, 2–4 June 2012; Interviewee 6, Ranchi, IN, 6–8 June, 2012; Interviewee 7, Cuttack, IN, 15–18 June, 2012; Interviewee 8, Cuttack, IN, 16–18 June, 2012; Interviewee 5, Raipur, IN, 12–13 July, 2012.

4.3. Policies of the research community

Finally, in order to identify and understand a research community, it is important to determine its policies (Wang et al. 2002). The policies of a community concern its shared norms (explicitly or implicitly spelt out) such as the exclusion/inclusion requirements of members, internal organisational dynamics and/or work culture and the involvement of farmers.

There are several criteria of scientist inclusion in this community. Primarily, if scientists are working on drought and rice and have a good reputation, they can be included. The institute (i.e. agro-ecological) location of the individual is also important, as it should be situated within a drought-prone environment or has access to a drought-prone research station to conduct trials. Sometimes funding agencies identify institutes, whose mandate is to conduct rice research for rainfed areas such as CRRI, and then CRRI nominate their scientists to this community. Sometimes individual scientists separately express their desire to be part of the community, in which case they are accepted for inclusion after a team from the community visits the institute and sees the kind of infrastructure they have with which to conduct research.

Membership of the community through formal inclusion of an individual scientist is not a fixed thing; on the contrary, it is always in flux, and in a variety of ways. The Rice Research Institute at Chinsurah, for example, was excluded from the community after an interim period of one year because it did not have proper infrastructure, such as fencing, for conducting trials.[9] Taking a closer look at the different GCP projects, it was found that some scientists from the community were included in or excluded from different projects because of specific funding criteria stipulations. Also, scientists in the community who are not interested in a particular project may opt out from that project. For example, Dr Robin from TNAU opted out from a fine mapping QTL project as it was outside his research interest. Instead, Dr Chandrababu from TNAU remained in those projects.[10]

Generally, institutional exclusion and inclusion procedures officially occur once every three years, with in/exclusion between being difficult. Maintaining a position within the community, however, occurs purely on a merit basis. The community has an annual planning and review meeting, which generally takes place at one of the partner institutes, where previous work is evaluated and planning for the coming period is done. Individual scientists present their work and decide (themselves) on the future work that they are going to undertake. Research assignments are distributed based on mutual assessment of how much work respective scientists are willing to do. Generally, the work culture of the community is friendly and democratic, based on debate, discussion and consensus building.

[9] Interviews: Interviewee 1, Hazaribagh, IN, 2–4 June 2012; Interviewee 2, Hazaribagh, IN, 2–4 June 2012; Interviewee 9, Los Banos, Philippines 2–4 May, 2012; Interviewee 7, Cuttack, IN, 15–18 June, 2012.

[10] Interviews, Interviewee 4, Coimbatore, IN, 25–26 June, 2012.

Each scientist has an equal stake in the community, and the scientist members state that everyone is given proper attention and is well heard. Scientists thus have a fairly high degree of autonomy in deciding how they are going to conduct their research; there is no imposition from the community as such. Proper recognition is given to scientists, who work together in a spirit of cooperation and collaboration for a common goal. They communicate among one another regularly through Skype, email and personal visits. Although the IRRI plays a leadership role, the community does not operate according to a hierarchical or centralised authority structure. The community is not moderated or controlled by any one partner institute, including the IRRI, through its structural rules and working practices, it is not a legal entity recognised by state instrument, and it is largely independent, autonomously deciding its research agenda and other matters. Regulatory decision-making organisations, such as the ICAR or CGIAR, cannot impose their research policies on the community. The project leader also visits regularly all the different locations and partner institutes to observe the experiments.[11]

Scientists willingly participate in this community, without any particular research obligation from their employer institutions. They participate for a number of reasons. Some of them participate to receive good quality breeding material from IRRI. Some participate because doing research within this community brings international exposure, with recognition from the scientific community as well as offering possibilities for good peer-reviewed publications, which would be difficult working alone. Some scientists participate because it offers them a possibility to develop the research infrastructure of their home institute (through the GCP projects, for example, CRURRS managed to acquire a rainout screening facility – standard price $2000 – and root scanner – useful for drought research). And finally, many scientists work in this community because it is another way for them to contribute to the agricultural sciences and to help farmers.[12]

This community exists at or as the confluence of several institutions, yet it is distinct from those institutions (Basu et al. Submitted) . There is certain vagueness about its existence, as it is difficult to locate through existing state mechanisms. However, ICAR (and CGIAR, for that matter) regularly evaluates the outcome of the projects that the network undertakes. This network has thus evolved as what might be termed a supra hybridized entity situated within a pseudo institutional sphere. This existence of this network in the pseudo institutional sphere gives it

[11] Interviews: Interviewee 1, Hazaribagh, IN, 2–4 June, 2012; Interviewee 2, Hazaribagh, IN, 2–4 June, 2012; Interviewee 3, Bengaluru, IN, 19–23 June, 2012; Interviewee 4, Coimbatore, IN, 25–26 June, 2012; Interviewee 5, Raipur, IN, 12–13 July, 2012; Interviewee 6, Ranchi, IN, 6–8 June, 2012; Interviewee 7, Cuttack, IN, 15–18 June, 2012; Interviewee 8, Cuttack, IN, 15–18 June, 2012; Interviewee 9, Los Banos, Philippines 2–4 May, 2012; Interview, Interviewee 12, Hazaribagh, IN, 4 June, 2012.

[12] Interviews: Interviewee 1, Hazaribagh, IN, 2–4 June, 2012; Interviewee 2, Hazaribagh, IN, 2–4 June, 2012; Interviewee 3, Bengaluru, IN, 19–23 June, 2012; Interviewee 5, Raipur, IN, 12–13 July, 2012; Interviewee 6, Ranchi, IN, 6–8 June, 2012; Interviewee 7, Cuttack, IN, 15–18 June, 2012; Interviewee 9, Los Banos, Philippines 2–4 May, 2012.

certain flexibility to conduct research that often complements the overall research programme of ICAR and CGIAR (Basu 2016; Basu et al. Submitted).

Scientists unanimously expressed their great enjoyment in working with the farmers during the PVS session. They are quite open in taking feedback from the farmers, and they learn a great deal from them (see below). It was also clear during the FDGs with the farmers that they have a high regard for the scientists and share cordial working relations with them. It emerged from the FDGs that the scientists did not behave in an autocratic or imposing way. Indeed, farmers often disagreed with the scientists and sometimes modified the prescribed practices according to their convenience and conventional wisdom:

> *Scientists asked us to sow the seeds of a particular drought tolerant variety while the field was dry, but because of the untimely rain, farmers went on to sow the seeds while the field was muddy. It was difficult to postpone the sowing or wait until the field was dry because of the delay in crop cycle. Sowing during the muddy field yielded a better crop than sowing in a dry field.* (PVS farmer at FDG).[13]

5. Discussion

In this paper, we aim at understanding the development process of Sahbhagi Dhan so as to know to what extent it can be called as commons. Taking the idea of *commons* as production systems, we have relied upon the notion of a community, defined in terms of an enterprise, such as the development of certain types of plant varieties. A community may also be viewed as a dynamic process in which actors with a similar interest, shared norms and/or organisational culture create a particular discourse (Berkes et al. 1989; Coe and Bunnell 2003; Mies 2014; Richardson 2015). Accordingly, in the previous section, the research community that developed Sahbhagi Dhan was analysed in terms of the scientific discourse the community developed, the process of community building and its policies (Wang et al. 2002). In this section, we first reflect upon the issue of community building and the process of commoning, and then we provide perspectives on commoning to address the critique of commons as a governance mechanism, as highlighted in Section 2.2.

5.1. Community building and commons

As illustrated in Section 4.1, through the process of developing the drought-tolerant variety Sahbhagi Dhan, the research community developed a particular scientific discourse on drought research. This scientific discourse is based on

[13] FGD with Farmers, Koderma District, Jharkhand, 14 December, 2012; FGD with Farmers, Hazaribagh District, Jharkhand, 17 December, 2012; FGD with Farmers, Chatra District, Jharkhand, 18 December, 2012.

three elements: first, making crosses between drought-tolerant donors and high-yielding, drought-susceptible varieties; second, growing these crosses through multi-locational trials; and third, involving farmer's preferences through PVS trials. This particular discourse on drought is now well established and recognised within the academic establishment (Kumar et al. 2008; Mandal et al. 2010; Verulkar et al. 2010; Kumar et al. 2012). The most innovative of these was the multi-locational trials, which involved the 'sharing' of large chunk of breeding material among different institutions. Without this community mediation, sharing of breeding material would have been much more difficult, as Material Transfer Agreements (MTAs) would have been required. Thus, we can speak of the sharing of breeding material as one of the main ways through which a shared enterprise (Hollenbach 2002) of drought research was created.

It was fundamental to the enterprise that members of the community remained consistent with the broad objective, crop improvement for drought. Members participate freely and willingly to contribute towards this shared goal (Deneulin and Townsend 2007). Although members have various micro goals, (getting good breeding material, helping the farmers, improving the research infrastructure, etc.), however, these do not contradict the broader goal. This particular objective of this community along with the scientific discourse on drought that it has developed gives the members of this community a shared identity and a common purpose with which they identify (Wang et al. 2002). This shared purpose and shared research trajectory created a stable community. Members also benefitted in many ways by participating in this community (Wang et al. 2002). Given the enormity of the drought problem particularly in the developing world (Bernier et al. 2008), this common purpose is also socially highly relevant.

The research community emerged as part of several networks that have been evolving over the last 20 years, and in that sense is under permanent (ongoing) construction (Coe and Bunnell 2003; Ruiz-Ballesteros and Gálvez-García 2014). This research community evolved as a dynamic process that was (has been) constructed in several ways, such as through different projects, funding agencies and geographical locations. Through this multifaceted layering, as it may be characterised, this community creates a semi-institutional space within the institutionalised research systems such as ICAR and CGIAR, enabling it to maintain its operational autonomy in working towards maintaining its established research and development trajectory (regarding rice variety development) (Hollenbach 2002; Deneulin and Townsend 2007; Caffentzis 2008). The autonomy of the community is also reflected within the policies of this community, which is *non-hierarchical*, *horizontal*, and *inclusive* in nature, a striking feature of commons in general and commons-based production in particular (Harvey 2012).

Also important is the *work culture* of this research community, which has a decentralised organisational base that operates through discussion, debate and consensus-building regarding the research planning and approach (Coe and Bunnell 2003; Richardson 2015). In a certain sense, the research activities of this community are developed within a *bottom-up flow*, whereby individual actors

participated in developing the initiative of a research community. Scientists who participate in this research community are doing this without any structural obligations from their respective institutions. This *volunteerism* and willing participation of scientists contributed towards maintaining individual as well as the collective autonomy of this research community. The decentralised organisation with non-hierarchical, horizontal, and inclusive culture of this community which is based on democratic discussion, debate and consensus building is a striking feature of this research community (Basu 2016; Basu et al. Submitted), as scientists within this community come from institutions such as ICAR and CGIAR that are mostly organised around centralised decision making in a top-down manner (Hall et al. 2001). It is an imperative for any commons based production to organise the internal dynamics in a non-hierarchical, horizontal and decentralised way (Harvey 2012; Richardson 2015), as is the case here.

Although stressing that discussion on commons is incomplete without community, previous studies (e.g. Berkes et al. 1989; Mies 2014) neglected to explain the various internal relations of the communities considered. Here, we tentatively posit the idea that development of a community-building process based on shared practices in relation to the creation and/or management of resources is the first aspect to look for commons understood in terms of production (Ruiz-Ballesteros and Gual 2012). The very fact that the community developed (and continues to do so) with the resource creation itself can be taken as denoting a degree of commons-based production system. All these characteristics – the horizontal and inclusive internal dynamics leading to bottom-up flow, volunteerism and autonomy – are recognisably democratic at a fundamental level, and thus contiguous with an intuitive sense of what we imagine of the common (and, indeed, with what we want from this notion). It is an imperative for any commons-based production that the internal dynamics of the community operate in a non-hierarchical, horizontal and inclusive way (Harvey 2012).

5.2. Perspectives for commons as production system

The following features of commons as production system are discerned from the empirical analysis of the development process of the Sahbhagi Dhan variety and the research community. This section also addresses some of the criticisms of the dominant discourse on commons. These are also some perspectives in which direction the commons scholarship should continue to explore.

5.2.1. Non-state and non-market realm of existence

This research community is situated in an overlapping institutional sphere of state institutions, NGOs and international institutions (Basu 2016; Basu et al. Submitted); it is itself neither public nor private in nature. This research community cannot be demarcated as a legal entity or identified through the state vocabulary. There is certain vagueness about the legality of this community as its existence is nebulous in terms of proprietary framework. No single participating

institution can exclusively claim its existence, and nor does any single institution claim ownership over its product (i.e. Sahbhagi Dhan). The community exists as a confluence of plural activities through collective action towards a common goal, and it can be seen as a *shared enterprise* in which *shared action* generated the process through which the Sahbhagi Dhan variety was developed and from which simultaneously actors benefited through participating in that shared process. Thus, the product that comes out from this process is neither public nor private in nature, but it is *a common*. It has been developed through shared action, as a *process of commoning*, and no single institution can claim exclusive right over it. This allows us to think beyond that which is either public or private (Öztürk et al. 2015). We move towards an understanding of the commons that involves a different form of imagination, one that is beyond the notion of policy, property and law as mainly recognised (implemented, enforced) by the state (Basu 2014). Therefore, the *non-state and non-market character* of the research community becomes an essential perspective for commons based production system. (Hollenbach 2002; Deneulin and Townsend 2007; Öztürk et al. 2015).

As a result, the dominant school on commons positioning of commons between state and market, somewhere in-between, is not valid here, as we see it is beyond state and market, public and private, or public-private or something in-between. The fact that many commons scholars emphasise the need to have commons arrangements recognised by the state or indicate a continuous struggle to this end (Hess 2008) is itself antithetical to the existence of commons. What happens when the state recognises commons? They become subject to regulation, and thus determined merely in terms of governance. Insofar as they are modes of relating for production, they are not things to be possessed even, they are not the goods of political economy but the ways of connecting between agents in society. In this sense of the common, recognition by the state limits the form of commons to what may be reified, and thence 'captured' by capital, like the state itself (Aier et al. 2011; Bandyopadhyay 2011; Cheria and Edwin 2011c).

5.2.2. Plurality and co-existence

This research community has been built around plurality. There are mainly three types of plurality involved in the community-building process reported here: 1) plurality in actors (both individual and institutional), 2) plurality in disciplinary activities, and 3) plurality in the sources from which resources (in terms of funding) have been mobilised. The community has been organised through several national and international research institutes, universities, NGOs and local farmer's organisation, and comprised of several individual actors in their roles as scientists, professors, administrators, extension workers and farmers. The research approach of this community is embedded within an interdisciplinary framework that comprises of several disciplines, such as plant breeding, biotechnology, statistics, plant physiology and social sciences. And, finally, the resource required for sustaining this community-building process has been mobilised from diverse sources of funding, first provided by RF, then GCP, now BMGF, with regular

costs, such as the researcher salaries and the research infrastructure, borne by the respective institutes.

Therefore, it can be stated that this research community does not aim at imposing singularity (Hardt and Negri 2009; Richardson 2015); rather it has thrived in conditions of *actor, discipline and resource plurality*, successfully creating conditions from among diverse practices for its ongoing existence and self-reproduction as an ongoing and dynamic form for a common objective (Cheria and Edwin 2011b; De Angelis 2014; Öztürk et al. 2015). This notion of plurality resonates with the abundance of resources that are characteristically non-rival and generally more difficult to enclose. And the practices of plurality within commons-based production or commons are very important, precisely because it negates the ownership debate in relation to the resource in hand. Commons are always vulnerable to enclosure, but the more plurality that is present in processes of community building, the less likely it is that these will (can) be appropriated by a single institution.

Referring to the dominant discourse of commons, a division between knowledge and natural commons is made. However, this case of Sahbhagi Dhan illustrates a product constituted by both natural resource (the plant variety itself) and knowledge (the trait of drought tolerance). Moreover, the knowledge of drought tolerance not only comes from the techno-scientific knowledge that is the domain of the scientists, but also incorporates farmer's knowledge within the variety-specific agronomic practices, especially as developed through the PVS process (such as that discovered with the dry-ground sowing). Therefore, we see a co-existence of knowledge systems within the development process. By accepting the contingencies associated with the farmer's knowledge and without filtering out that knowledge through scientific parameters, the development of this variety has created a space for both that enable them to complement each other. This also functions as an expression of plurality – and, indeed, of democracy (inclusion, equality).

6. Conclusions, implications and scope for future research on commons

Going back to the main research question of this paper: how and to what extent can the drought-tolerant variety Sahbhagi Dhan can be termed as commons? It may be concluded that the development of Sahbhagi Dhan was the common result of *cooperation* among various stakeholders which, in the development process, created and sustained a research community. Therefore, Sahbhagi Dhan can be seen as the social structural product of a research community. As far as the evolving community construction is concerned – at least as evidenced around the development of Sahbhagi Dhan – its autonomy, inclusive nature and non-hierarchical characteristics, its existence within a nebulous institutional level (distinct from state/market based institutions) and its sustenance based on plural resources, the variety can be regarded as something developed through a process of commons

and thus termed a common. More precisely, it is a hybridised common composed of both a physical component (the tangible one, for example the crop as such) and an informational component (an intangible one, for example, particular drought-tolerant traits that have been inserted into the crop). However, the fact that both GCP and STARASA, which funded the development of this variety partially, claimed the entire credit for its development, that the variety has been registered at the NBPGR, a government of India institution, and that the state is now involved in a large-scale seed multiplication programme for the variety indicate reasons for concern. There are here the possibilities of a conflict resulting in, for example, appropriation of the variety or loss of the farmer autonomy to produce the seeds. Further research will be necessary to follow the ways in which this variety and its production evolve.

Regarding the implications of our study for commons scholarship, three main points may be identified. First, one of the key features of commons as production system is the ability of this concept to go beyond the realms of state and market, of public and private or some public-private in-between arrangement. This is important as it emphasises the relations created within the production process. Standing outside the private-public divide, it may be noted, the notion of commons stands outside a conventional dichotomy of political economy. This research has shown that a flexible and dynamic institution was created that cannot be strictly demarcated as either public or as private, because it cannot be demarcated as a legal entity. Further, research on the concept on commons is required to reflect on what constitutes something as non-state and non-market to elaborate on the particular social relations that are crucial in such an understanding of commons.

Second, commons are always vulnerable to enclosure, but the more plurality is present in the process of community building (as it is shown in this case), the more possibilities to appropriate it by a single institution are less likely. And finally, the distinction between knowledge commons and natural commons as separate entities as often portrayed within the dominant discourses of commons does not seem an appropriate frame of reference with which to understand the concept of commons as production systems. The case of Sahbhagi Dhan illustrates that this product constitutes both a natural resource (the plant variety itself) as well as knowledge (the trait of drought tolerance) that makes it a *hybridised commons* in which techno-scientific knowledge as well as farmers' practices co-exist. Therefore, as we move in general towards a knowledge economy and knowledge society, further research is necessary on how certain natural resources have a certain knowledge component (historical contingencies of knowledge) and how both these (knowledge and natural) components can combine to construct the hybrid commons.

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