Sveriges lantbruksuniversitet
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Polemics around Genetically Modified crops

– Understanding the “problematizations” by the researchers and farmers in India

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Abstract

India is an agriculture based country where a big chunk of its population is employed in the agricultural sector. Despite significant improvements in food security mainly as a result of the Green revolution, farmers are still facing a list of problems. From among a range of solutions to help these farmers, GM crops were supposed to be an important one. The use of GM technology in agriculture gathered much attention worldwide ever since it came into practice and there are many different opinions about if and how GM crops can be of benefit to the farmers.

In this study the 'problematizations' of agriculture by two directly involved and relatively less heard actors in GM debate, the farmers and the researchers, is analysed. The study employs Bacchi's tool for policy analysis, the 'What's the problem represented to be (WPR) approach. This approach helps us understand that 'problems' are not objective, but that different groups of people might frame problems and associated solutions in different ways. This study also looks at how media has handled this debate so far as media has played a key role in this debate by (re)producing a large share of the GM discourse which affects the target audience.

Findings of this study show that neither the farmers nor the researchers prioritize problems that can be solved only by the use of GM crops. Both, farmers and researchers describe policy discrepancies to be at the core of major agriculture problems. The results revealed that the GM debate might actually be a little less polarized than it appears in the media. It also suggests that there is a need for improved communication between the farmers and the researchers to discuss farmers' problems as well as to generate awareness regarding new technologies. The study concludes that there are a lot of issues in agriculture which GM crops alone cannot solve rather they need a combination of solutions.

Keywords: Agriculture, problematization, WPR, discourse, GM debate, GM crops, farmers, agriculture researchers.

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Abbreviations

CACP	Commission for Agricultural Cost and Prices
FAO	Food and Agriculture Organization
FDA	Food and Drug Administration
GDP	Gross Domestic Product
GEAC	Genetic Engineering Appraisal Committee
GM	Genetic Modification
GMO	Genetically Modified Organisms
GoI	Government of India
GURT	Genetic Use Restriction Technology
ICAR	Indian Council for Agriculture Research
MMB	Mahyco Monsanto Biotech
MNC	Multinational Company
MSP	Minimum Support Price
NGO	Non-Governmental Organization
NITI	National Institution for Transforming India
PRA	Participatory Rural Appraisal
RCGM	Review Committee on Genetic Manipulation
WPR	What's the problem represented to be?

1 Introduction

Genetically Modified (GM) crops and the polemics around them have been present in our society for many decades now. The use of GM technology in agriculture helped to develop crops with pest resistance and herbicide tolerance (Tripp, 2009). Apart from these, other traits in pipeline are crops enriched with nutrients and improved tolerance to abiotic stress such as drought and salinity (Raman, 2017). Despite claiming to have anticipated answers to key agricultural problems, the technology itself, remained controversial (Stone, 2012). This controversy is not country specific but is widespread worldwide (McGiffen, 2005; Raman, 2017). The rubric of debate on GMOs contains a vast variety of opinions. Tripp (2009) says that a number of people are familiar enough about GMOs to deliver their opinions on this topic. This debate includes a list of issues such as food safety, impact on biodiversity, environmental concerns, corporate control of technology and biosafety regulations (Tripp, 2009).

Some of the early and leading countries in practicing GM cropping are USA, Brazil, Argentina, India, Canada and China, and the major GM crops grown in these countries are maize, soya bean, cotton, canola, sugar beet and potato (James, 2015). The present study focuses on India. India has the world's second biggest population now (1.21 billion according to census 2011) and it has one of the biggest shares of the population engaged directly in agriculture (around 55% in 2011, Macnaghten and Ripalda, 2015, p.105). India had already seen the "Green Revolution" in the 60s, and since 2001 GM crops have been present in the country, beginning with the commercialised farming of Bt cotton (Bacillus Thuringiensis cotton) beginning in year 2002 (Macnaghten and Ripalda, 2015) and more recently introducing brinjal, mustard, maize, chickpea and rice to the list for further discussion on field trials (Kumar, 2015). India's history with biotechnological advancement goes back to 1988 when the new seed policy on seed development was introduced and Mahyco Monsanto Biotech (MMB) company was founded (Macnaghten and Ripalda, 2015).

More than half of the cultivated area in India is rain fed (Suresh, 2014) which means that it is directly dependent on the climate for its success. With climate

change, the uncertainty attached with agriculture increases, increasing the risk for crop failures. In the past few decades, India has seen a decrease in the share of agriculture in GDP from 36% in 1980 to 19% in 2010 (Macnaghten and Ripalda, 2015, p.105) and increase in the number of farmers' suicides (Bodh, 2019). These have been attributed to a number of causes including farmer indebtedness resulting from high seed and agrochemical costs, significant problems with insect pests, weak governmental policies, lack of appropriate irrigation, for example (Thomas and Tavenier, 2017). Although it has not been possible to establish any strong connection between farmers' suicides and the introduction of Bt cotton, and the reasons for suicides are concluded to go beyond only the introduction of Bt cotton, the topic of farmer suicides has received significant attention in the GMO debate, and has been important for making the debate so polarised in and about India (Stone, 2011). Overall, GM crops are on the one hand suggested to be a possibility for improved agriculture by many scientists such as Florence Wambugu and on the other hand criticised by many researchers and activists including scholar and activist Vandana Shiva (Stone, 2004). This study is focused on the way the farmers and scientists 'problematize' the agricultural issues of India and what role they see for GM crops in addressing key problems.

GM technology *per se* has been discussed immensely, often in terms of its pros and cons, use and effects. There is a long list of authors both from natural and social sciences who have given it a thought from many angles and have thus tried to improve understanding. Nevertheless, the debate which arose with the emergence of this technology, does not seem to find a way to settle with these scholarly efforts. There could be many attributing reasons for this. The fact that the debate is not purely about settling on what is 'the truth' about GM crops, but rather that the GM crop debate is attached to inherently normative debates about how agriculture as well as society at large should be organized, is one explanation for this lack of settling.

This study is an effort to understand the GM debate with a focus on the 'problematization' of agriculture. One of the major findings of this study are that neither the farmers nor the researchers prioritize problems that can be solved by the use of GM crops only. Both, farmers and researchers describe policy discrepancies, rather than lack of GM technology adoption, to somehow relate to or be at the core of major agriculture problems. This study also shows that there is a need of improved communication between the farmers and the researchers where not only the researchers share their new technical ideas that they are working on but the farmers also share their problem that they would like to get help with as the researchers need to have a better insight of farmers' problems. Another important observation of this study is that the debate might actually be less polarized than it appears in the media. This conclusion comes from the portrayal of researchers as an extremely pro-GMO

actor group in the media, while in this study they were found to be reasonable and willing to listen to others, and not so unanimously for GMO. Exploring this long standing debate can also help in paving the way for effective implementation of the upcoming technologies in agriculture sector which might be able to solve some of the identified agriculture related problems.

1.1 Research Problem

The concerned stakeholders involved around GM crops in India are – farmers, scientists, consumers, policy makers, private agro-chemical companies, NGOs and environmentalists and media etc. Out of all those who are concerned, the actors that are active and vocal in the debate are policy makers, NGOs and activists, private agro chemical companies and media (Herring and Rao, 2012; Prakash, 2014) rather than the scientists and farmers that are comparatively less visible in the debate. This debate has been highly polarised on issues like - are GM crops good or bad, safe or unsafe, helpful or harmful. An example is the heated debate between Vandana Shiva's NGO Navdanya and the agro-chemical giant Monsanto on the topics of monopolization in agriculture, seed sovereignty, and their effect on farmers etc. (Shiva, 1993, 2013). Another example is the much discussed controversial episode of Dr M. S. Swaminathan where he was misinterpreted as having negative opinion about GM crops (published in "The Hindu", one of the leading newspapers in India).

In the light of this public controversy, and the relative absence of farmers and scientists in engaging in (and creating) it, this study proposes to explore what is the 'problem' that Indian researchers and farmers see that GM crops should solve, and how they construct this 'problem' differently. As GMO researchers and farmers are directly involved with the development and use of GM crops it is interesting to hear their voices on the topic, and perhaps a more nuanced picture on the debate can also be revealed than that produced by stakeholders currently engaging in the debate.

1.2 Purpose of the Study

As discussed earlier the voices of researchers and famers had been largely unheard despite them being key stakeholders engaged in the development and use of GM crops. It is anticipated that their views will be more pragmatic than other stakeholders who do not have a direct stake in this issue. Uplifting their voice by showing a systematic comparison between their views is an interesting way to contribute to this research field. This research aims at finding to what extent there is correspondence or dissonance between the descriptions of problems in farming that the farmers

describe and seek help for, and how researchers who are working on GM crops describe problems in farming and address these through the technological interventions that they have or will come up with. The purpose of this study is also to explore the various factors underpinning the controversies and apprehensions around GM crops which has had been in the country for nearly two decades now.

1.3 Research Questions

The research questions that will guide this thesis are listed below.

1. In what ways the farmers and the researchers describe the 'problems' in Indian agriculture?
2. How well these 'problematizations' correspond with each other?
3. How does discourse influence 'problematizations' and the construction of solution?

1.4 Thesis Outline

This thesis is divided in seven chapters. Chapter one situates the purpose of the study, research problem and research questions in the wider literature on the topic. The next chapter is about the background setting where I discuss in detail the debate around GM crops in India. In the third chapter I will discuss the theory and approaches used in this study. The following chapter is about methodology where I enlist the methodological decisions taken by me in the process of this research. The fifth chapter is about the empirical findings of this study which also deals with the comparison of views of the two farmers groups and the researchers. In the next chapter "discussion", I will elaborate on correspondence of views and construction of the solution in light of the available literature on this topic. The seventh and last chapter is about the conclusions of this study which will also cover some limitations and suggestions.

2 Background setting

In this chapter, background information related to this study is provided. A brief note on GM crops and the debate in the global context (its genesis and current status), Indian agriculture and GM crops and actors involved in the debate on GM crops in India is presented here.

2.1 GM crops and the debate in the global context: Genesis and current status

Genetic modification is an area of biotechnology where the genetic material of a living organism is altered or manipulated to enable them to perform explicit functions. GM food is produced as a result of genetic modification in an animal or plant (Zhang et al 2016). Modification in crops were first recorded approximately 10,000 years ago in Southwest Asia with practices of "selective breeding" for the domestication of crops. In case of agriculture, antibiotic resistant tobacco and petunia were the first GM plants, successfully produced in 1983. China was the first country in 1990 to start commercial cropping of GM plants with GM tobacco for virus resistance. Later, in 1994, a variety of tomato became the first GM plant in USA which was approved from FDA (Food and Drug Administration) for human consumption (Raman, 2017).

The debate over GM crops involves issues such as regulatory process, ethical considerations, environmental consequences and globalization (Yamaguchi, 2007). These issues are often discussed on the basis of some pivotal "facts". Each of these facts come from a variety of systems. Since both the proponents and opponents of GM crops have meritorious knowledge base and their own "facts", it ultimately leaves the audience of this debate even more confused. Stone (2011) comments on the consequences of "myopic" sense on the trajectory of GM debate, to be detrimental. His notion calls for a prudent attitude towards the debate as it may have

many unforeseen and underlying effects for the society. On the other hand, agnosticism over the GM crops had been repeatedly questioned by Herring (2013, 2015). He categorizes this scepticism as a routine which is not unique with the GM technology and occurs with any technological advancement (Herring, 2012). However, the precautionary measures taken in case of GM crops should not be seen as unscientific obstructionism but as a framework for learning (Jasanoff, 2000).

As of 2018, a total of 17 million farmers are growing GM crops on approximately 191 million hectares land in the world. The list of GM crops has 27 crops and among all these crops maize has the largest approved events. Soybean covers 50% of the global GM crop area. A total of 70 countries have adopted GM crops (26 countries planting and 44 countries importing GM crops). The adoption rate (adoption of GM technology by the farmers) of GM crops is highest in USA (93.3%) followed by Brazil, Argentina, Canada and India which are the top 5 GM growing countries in the world (ISAAA, 2018).

There had been a few significant episodes of controversy in GM technology debate that shook the world. It is worth mentioning some particularly important controversial episodes to understand the complexity and nature of the debate. One of these controversial episodes which can be easily recalled is "The Seralini Affair". In the year 2012, a controversial GM crop study by Gilles Eric Seralini, a French scientist, was done on the effects of GM crop (Monsanto's herbicide tolerant GM maize variety) on rats. The finding of this study were basically deteriorating health conditions of the test animals including organ dysfunctioning, tumour development and high mortality as a result of the consumption of GM maize. The paper gathered huge criticism alleging it to have faulty experimental setup and poor data handling and was later retracted. Nevertheless, even today, this controversial episode is mentioned in the GM debate. This study has fuelled the arguments of GM opponents and thus made Seralini a central actor in the GM debate since then (Raman, 2017).

Similarly, another distinguished name in GM technology is Norman Borlaug who is an American plant scientist, Nobel Laureate and "The Father of Green Revolution". His work in the field of agriculture in general and GM technology in particular is noteworthy. However, Stone's 2016 article criticises the loop holes of both "Green Revolution" and Golden Rice (a fortified GM rice variety). Here he presents a plethora of evidences which shows the possible effects of disembeddedness of a biological process and its discursive context (Stone et al, 2016). This article criticises and compares the three "rice worlds" namely GM Golden Rice, Green Revolution rice and the heir loom rice in Philippines on the basis of geographical embeddedness and local agro ecological context in the construction of a crop. Critiques of Norman Borlaug's work is not new and continue to appear in a variety of shades ranging from articles and rap songs praising him (Daunert, 2008) to denouncement in many articles. All these controversies spanning from the start of the technology

till today indicates that GM has been a controversial topic throughout time with the involvement of various actors.

2.2 Indian Agriculture and GM crops

Overview of India and Indian agriculture

India is a megadiverse country having about 22 major languages and 415 dialects. The boundary of India has the highest mountain range in the world, the Himalayas to its North, the Gangetic delta is running in its East, the Thar desert is situated to its West, and the Deccan Plateau in the South. This country has a massive agro-ecological variety. In terms of production, India is the world's largest producer of milk, jute and pulses, and second largest in rice, wheat, sugarcane, groundnut, vegetables, fruits and cotton. Spices being one of India's specialities, it is a leading producer of spices. Fish, poultry, livestock and plantation crops are also there in the list of India's produces. India is the world's third largest economy with a worth of $ 2.1 trillion, after the US and China. (FAO, 2019).

In order to locate the GM debate in the Indian context, it is important to understand the evolution of Indian agriculture. A large population of India is agrarian and rural and out of this agrarian population 85% are marginal or smallholder farmers (Macnaghten, 2015). India has one the world's biggest farmers' population having to be served by a huge scientific establishment and a dynamic biotech-entrepreneurial sector (Scoones, 2002). Despite India's big population, it has managed to gain food self-sufficiency by a mixture of three elements- technology, policy and institutions (Shekhar, 2014). India performed well in agriculture and its food grain production increased multiple times making it a net exporter in 2013 from a net importer of food grains in 1951 (Shekhar, 2014). Ironically, while India is considered to have achieved food security and increased its food export, there is also an increase in the rate of farmers' suicide (Bodh, 2019).

Despite India's grain self-sufficiency, its agriculture sector is still facing some concerns. Some of the production related issues are that it is heavily resource demanding, revolves around cereals and the production is predisposed to a particular region. As a result of increasing stress on water resources, desertification and land degradation, India is in dire need of a policy reform and change in the management of agricultural practices (FAO, 2019).

Some important institutions and devices emerged with the course of time to help the Indian agriculture perform better. CACP (Commission for Agricultural Cost and Prices) was established in 1965 to provide a stable and safe price environment to the farmers of India. CACP recommends the MSP (Minimum Support Price) for a

crop each year based on certain factors (CACP, 2019). MSP is fixed by the government before the sowing season starts. The expected role of MSP is to provide guaranteed protection against price fluctuations and market imperfections which leads to the enhancement in embracing the modern farming practices by the farmers (NITI Aayog, 2016).

India has some institutes dedicated toward the improvement of agriculture and ICAR is one of them. ICAR (Indian Council for Agriculture Research) is one of the largest agriculture organizations in the world and was founded in 1929. It takes responsibilities for coordinating, guiding and managing research and education in agriculture. It has 101 ICAR institutes and 71 agricultural universities all over India (ICAR, 2019).

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Although India started to prepare for the adoption of GM crops already in 1988 when the New Seed Policy was introduced and MMB was founded, its first GM crop, Bt cotton started to be cultivated officially in the year 2001 (a retrospective decision came in 2002) (Macnaghten, 2015). So far, Bt cotton is the only GM crop which has been officially approved for commercial cultivation in India. Today, India is the largest cotton producer in the world (Rani, 2018). However, in the recent past, GM mustard and GM eggplants also gathered much attention in media nationally and internationally. A list of 21 crops for field trial is still awaiting until further notice (Rani et al, 2018).

India is a specifically observed frontier for Bt cotton (Stone, 2011). The debate about GM crops in India first came into attention in 1998 with the controversy of 'terminator gene' (Shiva, 1998 in Scoones, 2008). Terminator gene or terminator technology is a term used for GURT (Genetic Use Restriction Technology). It is a technology which allows to either restrict the use of a plant variety or a specific feature in a plant variety. This means that GURT can help to control the expression of a beneficial feature in the GM plants (CFIA, 2012). By this time, a public relation war had already started widely between Monsanto and some NGO groups. Slogans like - cremate Monsanto, stop genetic engineering, no patents on life and bury the WTO were flashing in the media. Later another form of protest against the approval of Bt cotton started in the form of burning the farms of Bt cotton to destroy the crop, filing Public Interest Litigation and publications with a different narrative showing the other side of the story (Scoones, 2008). It is clear from these criticisms that the critique of GMOs was strongly associated with a critique of multinational companies and their dominance over the technology.

This controversial journey of India's GM crops or in this case, Bt cotton had been studied vastly by many scholars especially in terms of success and failure of this crop but the debate still continues (For example, Herring, 2013; 2015, Stone,

2011; 2012). On the other hand, how controversies define technological transition is yet a relatively less explored topic (Ramani, 2015). Fischer (2015) also explains in her study that despite the discussion of farmers' wellbeing in many studies, a significantly less attention has been given to explore it empirically. It can thus be understood that measuring the success and failure of a GM crop based on mere numbers has a dubious outcome as it might be of only a little help in solving the debate which has a complex nature involving issues of social context in addition to economic and environmental issues.

2.3 Actors involved in the debate on GM crops in India

Actors involved in the contentious GM debate in India are divergent including activists and NGOs, agrochemical companies, policy makers, media, researchers, farmers and the consumers etc. Out of these actors, the farmers are the least vocal even though India has comparatively a significant number of smallholder farmers adopting GM crops (Stone, 2012). The scientific fraternity is in a similar position whereas the media, NGOs and agrochemical companies are the most vocal ones. These variety of actors have been involved in the debate has generated more confusion and increasing public mistrust in science (Yamaguchi, 2007). The emphasis in this study is not on understanding the problem itself (in this case, the credibility of GM technology) rather it is on the way GMOs are perceived and described by some of these actors namely, farmers and researchers, and their base in the wider discourses around GM crops.

If we look at the genesis of GM crops in India, we can identify the stages with a focus on policy shift and related events (Ramanna, 2006; Macnaghten, 2015). These stages have strings attached to one or more actors who are involved in these shifts and events. Some of these actors who are prominent in the debate are M.S. Swaminathan and Vandana Shiva. These two are also discussed in Ramanna's article on the Indian policy shift on GM crops in addition to a few more eminent actors. In her article she argues that both the pro and anti GM regime actors have different narratives yet both are influential enough and make networks to shape the policy on GM technology. She describes the critiques and concerns raised by Vandana Shiva on GMOs, who is an activist working on issues like globalization, patenting, seed sovereignty & feminism. Vandana Shiva holds a PhD in Physics and founded an organisation called Navdanya. She is very vocal about the GM technology and Monsanto in particular both nationally and internationally. Her role in this debate on GMOs is important to understand as she has done considerable communication on this topic. In all her work, the reflection of dissatisfaction with the policies and worry towards the monopolization of Indian agriculture by agrochemical giants like

Monsanto is evident. However, the pro GM actors and the media usually describe her work as loud yet weak with facts (Johnson, 2014) making her seem like a "luddite" (Senapathy, 2015).

Another eminent personality, M. S. Swaminathan also got tangled in this debate on GM crops. He is a leading scientist in the field of biotechnology and regarded as the "Father of Green Revolution in India". Ramanna's description of Swaminathan's views denotes that he is a strong proponent of GM technology in agricultural advancement who emphasises on GMOs' capacity to bring an "Evergreen revolution" meaning a green revolution where we are able to overcome the negative environmental impacts that were associated with the yield gains of the Green Revolution (Ramanna, 2006). Therefore when his name appeared as co-author to an article that did not only herald Bt cottons' success but brought up some aspects where Bt cotton has not worked optimally, this turned into a media hype where the article was portrayed as dismissing Bt cotton as a failure, and M. S. Swaminathan portrayed as having turned against GM crops. In the face of this media storm and after being criticised by many scientists- and as he felt misinterpreted, he continued to promote GM crops by reiterating his commitment towards GM technology through the communications he did after this controversy arose. Swaminathan argued that the paper was being misinterpreted and the conclusion of that article was that the GM technology would work well for crops under "abiotic stress" comparatively more for those under "biotic stress". (Published in The Hindu)

Another actor in this GM debate in India worth mentioning is MMB also known as the Mahyco Monsanto Biotech Company. It is a collaboration between the renowned agrochemical giant Monsanto (bought by Bayer in 2018) which is an MNC (multinational company) and Mahyco, which is a subsidiary of some other MNCs including Syngenta, Bayer, Tata group etc. collaborating with some completely Indian owned seed companies (Ramanna, 2006). Monsanto has three Indian subsidiaries including Monsanto India, Monsanto Enterprises and Monsanto Chemicals. MMB was founded in 1988 which was an important and very first event in the chronology of India's GM crops (Macnaghten, 2015). Today, MMB is fighting the legal battle against the "patenting" of plant material and faced a defeat at the Delhi High Court in 2018 (Published in The Hindu's business line).

GEAC (Genetic Engineering Appraisal Committee) and RCGM (Review Committee on Genetic Manipulation) are the two statutory bodies responsible for genetic modification technology in India established in 1994. These two institutions are critical to mention here as their role is of immense importance in this study. Bt Cotton was found to be illegally grown in India in 2001 and thus in 2002 a retrospective approval for Bt cotton commercial cultivation was granted. Since then there has

been many ups and down (especially with the change in the government at the national level) for GM crops in terms of moratoriums and approvals for field trials of 21 GM crops such as brinjal, mustard, chickpea, maize and rice (Rani, 2018).

3 Theoretical framework

3.1 Introduction to WPR approach

Carol Bacchi, in 1991, introduced an approach to critically examine the taken for granted ‘problems’ or ‘problem representations’ in public policies. She termed this the “WPR” approach, short for “What’s the problem represented to be”. WPR is a means or tool to critically cross-examine the underlying assumptions of public policies. Yet, the essence of the WPR approach can be made useful in many other situations where the focus is on understanding how something is being perceived and defined differently by different people (or under different circumstances) who may have different agendas and backgrounds. Bacchi (2009) says that the policy proposals inherently (but often implicitly) envision a ‘problem’ which calls for a specific action (or policy) to mitigate this ‘problem’. But she draws our attention to that these ‘problems’ are not objective facts but that all problems can be thought about in different ways and that different framings of problems and solutions can be positive or negative for different groups of people. By using WPR, policy proposals can be scrutinised thoroughly to gain a deeper understanding of how ‘problems’ are framed in particular policy proposals and what this leads to. In order to do this scrutiny, a bunch of six questions are used. These questions are regarding identifying the ‘problem’ represented to be in a policy proposal, assumptions underpinning this representation of the ‘problem’, how this ‘problem’ representation has taken place, can there be other ways to see this ‘problem’, what are the effects produced by this ‘problem’ representation and also regarding the ways in which it can be questioned, disrupted and replaced (Bacchi, 2009).

Bacchi (2009) suggests that it is of paramount importance to understand *how* something is perceived as a problem instead of focusing on only *why* is something defined as a problem. This draws attention towards the “problematisation of the

problem" which is a thought provoking process of questioning the postulates (Bacchi, 2012). Problematisation was introduced by Paulo Freire in the early 70s and had been explored intensely by Michel Foucault (ibid.). By using the method of 'problematization' focus shifts from looking for the right answer to the analysis of how reasoning is being done around a topic (Deacon, 2000 in Bacchi, 2012). In case of WPR, the 'problem representation' is considered to be a way of making specific proposed pre -planned actions seem as logical solutions. We can 'problematize' this 'problem representation' by using the WPR approach which would help in a thorough contextual analysis of a policy proposal or any other proposal one plans to be involved in (Bacchi, 2009).

3.2 Discussion on the use of WPR in this research

WPR suggests that if we can understand the practices and processes that have guided a problem representation in a particular way, then it might be possible to analyse the situation in a different way (Bacchi, 2009). The reason for using WPR as the central theory while researching the GM debate is that I wanted to understand how farmers and researchers framed the key problems in agriculture, to what extent they saw similar or different problems, and if GMOs could be a solution to any of these problems. WPR served as a suitable tool here because it helps us understand that 'problems' are not objective, but that different groups of people might frame problems and associated solutions in different ways. WPR gives us tools for asking questions about what kinds of underlying assumptions that different 'problem framings' or 'problematizations' are based on.

As discussed earlier, WPR is primarily used in the context of policy analysis yet, we can put this to other uses as well. In this study the essence of WPR which is to understand 'problematization', is being used by reformulating the original six questions introduced by Bacchi to a bunch of suitable questions to cater the need of my research.

This study is guided by the following questions:

1. What's the 'problem(s)' in agriculture as described by farmers?
2. What's the 'problem(s)' in agriculture as described by researchers?
3. What is the problem that researchers describe that GM crops can be a solution to?
4. What assumptions underpin this representation of the 'problem', and the construction of GM crops as a solution?
5. How has this representation of the 'problem' and its solutions come about?
6. What is left unproblematic? Where are the silences? What is not being discussed?

7. Can the ‘problem’ be thought about differently?
8. What effects are produced by this representation of the ‘problem’?
9. How/where has this representation of the ‘problem’ been produced, disseminated and defended? How has it been (or could it be) questioned, disrupted and replaced?

These questions helps in keeping the focus on studying and exploring how the two important and directly involved actors of GM crops present and perceive the issues related to the GM debate. On the one hand, some of these questions can be analysed directly as the researchers and farmers have answered them by themselves making them the backbone of this study. On the other hand, some of these questions need a detailed analysis of genesis and the current status of the GM debate and Indian agriculture to understand the assumptions underpinning the problem representation, silences and the origin of how has this problem representation come about. Bacchi (2009) says that a current style of problem representation is often an inevitable result of its evolution over a period of time and in order to analyse this problem representation, we should avoid assuming things and look at the problem, critically paying attention to the minute details and turning points. The same can be used as a touchstone as this debate is also dependent on many assumptions and speculations from actors making uncertain claims, both who are in favour of GM crops as well as those who are against it. Examples of these speculations can be seen in many articles related to GM crops like the ones discussed by Stone (2017) where he lists a range of claims made by researchers based on their assumptions and speculations. One of the commonly made claims by researchers in public debate is that GMOs are safe. Here Stone suggests that such statements are too simplified and will be rejected by a critical public. Instead we need honest scientific brokers to detangle the threads of this GM debate and do not provide simplified explanation. Honest brokers, as Stone suggests here, are the “basic scientists” who understand GM technology and its underpinning science and can help in the fact checking of claims made regarding GMOs. A list of well-known examples of claims by the researchers are discussed in this article in comparison with the probable responses by the honest scientific brokers to explain how can this rhetoric of GM debate be dealt with the help of more science and logical reasoning.

The aim of using this set of reformulated questions (listed at the beginning of this section) is to dismantle the GM debate cautiously and be able to respond to the three research questions which are regarding the ‘problematizations’ of agricultural problems by the researchers and the farmers, their degree of correspondence or dissonance and the construction of GM crops as an answer to some of these problems.

The GM debate is so far an ongoing dispute among a range of actors with varying interest and agenda. Each of these actors is attached to a set of discourses which leads them to participate in the debate in a certain way. Also, concurrently, their

active or passive participation in the debate helps to shape their discourse. Understanding the concept of discourse and its role in the context of this study is important as we know that the meaning of discourse changes in different contexts (Bacchi, 2009).

3.3 The role of discourse in 'problematization'

In order to analyse the assumptions, silences and alternatives in a particular style of 'problem representation' and also to understand how and why something qualifies as a 'problem' in the first place, the analysis of the role played by discourse in this 'problem representation' is imperative. Discourses, as described by Fairclough are, "ways of representing aspects of the world" and also "perspectives on the world" (Fairclough, 2004; p. 124). As such we can see discourses as something larger than individual problem representations. In the WPR approach, Bacchi (2009) suggests that discourses possess immense power, so much so that they have the ability to make things happen which is often based on the fact that they have the status of the truth.

A discourse does not remain fixed and keeps changing its shape as it is not homogeneous and holds tension and contradiction internally (Bacchi, 2009). This lack of homogeneity and varying status makes discourses susceptible to change in different situations especially when there are competing discourses challenging it (ibid.). This idea can help in analysing the GM debate by taking into account the various discourses involved in this debate. The possibility of a clash between these discourses can thus be explained by using Bacchi's view about the status of discourse where she says that "Some discourses have greater status than other discourses" (Bacchi, 2009, p. 36). She further explains that the varying status of discourses may occur as some discourses are sanctioned by strong institutions. It is the same in case of GM debate where some of the discourses involved are sanctioned by institutions like research institutions, NGOs, political institutions etcetera to name a few.

Bacchi (2009) suggests that the discourses can hold tension and contradiction internally, which can be related with the GM discourses as well. For example, a widely known GM discourse is that GM crops can lower the use of pesticide in agriculture which is both supported and contested in different situations. The GM researchers' often use this discourse in favour of GM crops which is contested by many activists and environmentalists. These activists and environmentalists contest this GM discourse on the basis of some GM crops' field studies such as Benbrook, 2001. Stone, 2002 also discuss cases of pest resistance in the due course of time which needs pesticide again for the protection of the crops and use of pesticide

against other pests (which are not intended in that GM variety) are reported and draws attention on the complexity of this issue.

Bacchi says that discourses are not fixed and keeps changing, it makes sense in case of GM debate as well. For example, farmers' discourse regarding GM technology changes with their experience and exposure to GM technology and this is a probable reason (in addition to the material circumstances) why the GM farmers and non GM farmers describe and enlist agricultural problems differently.

As the aim of this research was to understand the 'problem framing' of the farmers and researchers, the concept of "strategic framing" as discussed by Bacchi (2009), appears to be useful. She says that strategic framing is basically shaping an argument deliberately to get support to a particular cause. In this study the researchers discussed the problems of Indian agriculture and how GMOs can be helpful in solving (if possible) some of these problems. If the enlisted problems of agriculture by the researchers did not obviously suggest GMOs to be the best option and the researchers still advocated that GMOs can be useful in solving the problems of agriculture, it can be explained using "strategic framing" by the researchers. Here the strategic framing is considered to be done to favour the use of GMOs in agriculture despite the need of other possible solutions and strategies which are indicated by the list of problems in Indian agriculture as described by the researchers.

The thought that "We are governed through problematizations" (Bacchi, 2009, p. 25) puts us to ponder the way we are currently looking at the GM debate. This is because the GM debate is not only about the GM crops but it also involves elements of how our society functions. As Bacchi says that it is not the 'problems' that we are governed through but the ways 'problematization' is done, governs us. Similarly, in case of the GM debate, the 'problematization' of *GM crops* are being done by different actors based on their discourses rather than 'problematizing' *agriculture* to see if GM crops can be an apt solution to some of these problems which can only be solved by the use of this technology.

4 Methodology

This chapter discusses the research approach of this study. The research questions led to the selection of a qualitative approach for this study which is undertaken to explore the meaning that individuals or groups (researchers and farmers) assign to a human or social problem (polemics around GM crops in this study) (Creswell, 2014). Here I describe the reasons behind the decisions taken for the study site and the participants. A brief discussion of the qualitative data collection method and process will also be done which is the bedrock of the whole story presented in this thesis. Ethical considerations I made during the research are presented in this chapter. The process and method of data processing and analysis is discussed at the end of this chapter.

4.1 Philosophical Worldview

This study has the features of a constructivist world view as the focus of this study is to depend on the participants' interpretations of the topic being studied (Creswell, 2014). In case of a constructivist worldview, the researcher tries to build up or interpret how other people make sense of the world they live in (Creswell, 2014). Also, in constructivist worldview, the researcher's own background helps to outline their interpretations and so the researcher places him/herself in the study to admit and clarify that these interpretations have come from their own culture and past experience (Creswell, 2014). Indeed my own background has also to some extent inspired my interpretations about this topic relating to the debate around GM crops in India as I am an Indian and have studied both science (at bachelor's level) and social science (at master's level).

4.2 Research Design

Research design concerns purpose, theory, research questions, methods and sampling strategy which have to be taken care of while doing a research (Robson, 2002). For this research, the qualitative design was selected based on the research problem. In qualitative studies, the "why" part of an issue or event is investigated which refers to the qualitative part, instead of the "who" or "how much" kind of question which mainly (but not always) refers to the quantitative part of an issue or event. It means that in order to understand the reasons behind a phenomenon, which is usually more explanatory, we can opt for a qualitative study (Creswell, 2014). This research is designed to understand the 'problematizations' of agriculture as experienced and described by the participants of this study. It is important to note that I am not analysing the case of GM debate from my point of view, rather I am analysing the way the participants describe and formulate their experiences around the GM crops and the debate and the perceptions they have towards this issue. The qualitative research design, therefore, holds most suitable to this study.

4.3 Study site and participants

This study was done in two states of India and required interaction with two sets of participants. The first set is the researchers having experience of GM in agriculture and the second set is the farmers. Now in order to understand and explore the farmers' perspectives even more clearly, I subdivided the farmer group into two categories. The first one is the group of farmers who have done or are doing GM cropping and the other one is the group of farmers who have never done GM cropping. By doing so, I could also make a comparison of the perception of these two different farmers' groups which also belonged to different geographical locations.

The study started at Lucknow, Uttar Pradesh, the most populous state in India. It is situated in the northern part of India and right next to Bihar which is my home state. The reason to choose Lucknow was based on the short travel time and the ease of language which is Hindi, my mother tongue. The economics of Uttar Pradesh is primarily based on Agriculture and approximately 65% of the total population is dependent on agriculture. The role of the agriculture sector is substantial in the economic development of this state. According to the survey of 2014-15, approximately 16.598 million hectare (68.7%) land is used for cultivation in Uttar Pradesh (Agriculture department, Uttar Pradesh, 2019).

Lucknow is the capital of Uttar Pradesh and here I interviewed most of my researchers (10 out of 11). During my stay in Lucknow, I had a chance to witness a farmers' meet (Kisan Mela). At this meet approximately 5,000 farmers came to a common platform, CIMAP (Central Institute for Medicinal and Aromatic Plants) to

discuss their needs, achievements and problems. I grabbed this opportunity to use this platform to interact with some of the farmers and to organise two PRA exercises: trend analysis and problem ranking, after the culmination of the event. The participating farmers had come from the nearby villages and brought different experiences with them which enriched our interaction. Since I have stayed and studied in Uttar Pradesh for a long time, I could understand their dialect and relate with their experiences easily. This is something I did not pay much attention to until I visited Hyderabad, Telangana where I needed a translator to interact with the farmers. Approximately 8 farmers participated in the PRA exercise at Lucknow. Apart from Lucknow I also went to Hyderabad which is the capital of a southern state in India called Telangana. Hyderabad is the hub of Indian IT sector and well known for its agriculture owing to two major rivers - Godavari and Krishna making it a cultivable land for the farmers. Major crops grown are cotton (Bt cotton), sugar cane, rice, mango, tobacco, onion and chilli etc. People speak Telugu in Hyderabad but they also understand basic Hindi and English. The reason to choose Hyderabad was dual. Firstly, to get a chance to meet diverse farmers, from north and south of India (Lucknow being north and Hyderabad being south) and secondly, this is a state where Bt cotton was grown by the farmers and so I could interact with the farmers who are doing GM cropping. A group of 10 to 15 farmers was anticipated for PRA exercises but I was fortunate to have around 35 to 40 participants as they had gathered to celebrate Women's day at their community hall at a village called Narsapur, Hyderabad.

4.4 Qualitative data collection

> "Information does not just exist 'out there' waiting to be 'collected' or 'gathered', but is constructed, or created, in specific social contexts for particular purposes". (Mosse, 1994, p. 499)

The data collection method for this study was divided into two parts. The first part was semi structured interviews or qualitative interviews with the researchers and the second part was two PRA exercises with the farmers. Apart from these two methods observation was also done throughout my stay in India sometimes planned and sometimes unplanned as farming is quite prevalent in India. Although I did not document everything that I observed but when I write, they come to my mind and somehow shape my analysis.

Interviews

Qualitative interviews are done to draw on the opinion of the participants and have mostly unstructured and open ended questions (Creswell, 2014). For this study, I interviewed 11 researchers who had some experience of GM in agriculture. The questionnaire which was used for the discussions had open ended questions leaving room for a broad discussion. The interviews lasted for 45 to 90 minutes approximately (depending upon the availability and gesture of the researcher). All the interviews were done face-to-face ensuring the data collection not only through verbal but non-verbal communication too. I felt that non-verbal cues play a key role in capturing the essence of the discussion hence, essential. All the interviews were recorded and later transcribed by me. The participants were informed earlier via an email describing the purpose and background of the study. What attracted the researchers the most was the theory used in this study, the "WPR" approach, which is the backbone of this entire research. During the interviews, I felt that it was quite easy to engage the researchers in this discussion and they indulged in the discussion deeply. This indulgence was good on one hand for me as it gave me much information which I actually did not intend to capture through my original questionnaire. On the other hand, sometimes it became messy and hard to keep my focus on the discussion points and I missed some of the expected information. I kept a field diary throughout data collection and it helped me to engage with the researchers in a better way, each succeeding time and also, I was able to do the primary analysis even during the course of data collection.

During the discussion with the researchers, I sensed that they are easy to engage in the discussion on this topic despite this group being comparatively less heard in the public debate in India. It had helped me in having a comprehensive talk within and even out of the semi structured questionnaire that I had with me. After each interview I did my primary analysis by entering the details roughly in my field diary. This practice helped me to do a mind mapping of the themes or sub themes for this research.

Participatory Rural Appraisal (PRA) exercises

PRA is considered to be a method or approach to learn about rural people's opinion about their own problems, resources, capabilities and needs etc. (Chamber, 1994). The PRA tools that I chose for this study are trend analysis and problem ranking. The reason for the selection of these two tools particularly in combination was based on the research problem. The farmers were a little shy in the beginning but soon became comfortable since the topic of discussion was very close to them and they knew a lot about it. The data collection involved some principles of participatory research such as participation, flexibility, team work, triangulation and optimal ignorance (Cavestro, 2013).

Figure 1. Political map of India showing study sites ( ) and home town ( )

I could not tailor the discussion as I had planned it in my mind owing to the features of PRA, flexibility and adaptability. Despite this, the discussion was informative and I could understand the trend and problems in agriculture in that area. The exercise lasted for about 40 to 60 minutes for each PRA exercise. I tried to organize PRA exercises at Hyderabad separately for men and women farmers to get a deeper insight on their different perspectives. The reason to do so was also because I had a big group (more than 35 participants) and sufficient time to carry it out. Although I organised it successfully, since I was dependent on a translator, I felt that I missed the delight of listening and participating directly as I did at Lucknow where a group of about 8 farmers (both men and women) were involved in this PRA activity. The main aim of this activity was to understand the changes in the trend of agriculture so far.

The thought that I had while designing this research was that I wanted to understand the debate as clearly as possible from the point of view of farmers and for that I decided to go for trend analysis. Trend analysis is the documentation of the pattern

of changes in the community and shows the effects and reasons of these changes (Calub, 2003). By doing this exercise with the farmers, I got a picture of the agriculture systems so far and also it had set the background of the next discussion about the problems that they are facing today in agriculture.

After the trend analysis, problems of agriculture was discussed with the farmers. Problem ranking is done to identify, compare and prioritize the problems of an area to give solution, other options and recommendations (Calub, 2003). It was the main focus for this study as the researchers were also asked about the problems of Indian agriculture and by this, I could actually compare the differences or consistencies in how these two actors 'problematize' Indian agriculture. The farmers were to-the-point regarding the problems that they are facing and listed many specific yet critical problems. Sometimes it was a bit difficult for the group of farmers to come to a consensus about ranking them as everyone had a different experience but after a little discussion it could be done.

4.5 Field Experiences

Since a transparent account of my field experiences will help to understand this research well, I am sharing it briefly here. The data collection was done between end of January 2018 to the middle of March 2018 in India. It was interesting to explore the agriculture sector where I was drawing a sketch of transition from the traditional to the modern farming practices. Agriculture is so prevalent in India that while collecting data, I felt that the farmers were talking comfortably about their daily life without hesitation. Since the focus of this study was to understand how the farmers and the researchers see and describe the problems of agriculture, I had to discuss their experiences which makes the basis of their particular 'problem' representation. Using an interpreter at the second site of data collection made me realise that these experiences shared by the farmers speaking in Telugu would have helped me to gain a deeper understanding of their 'problem' representation.

With regard to the interviews, getting appointments from the researchers was a little puzzling. In fact, getting in touch with the suitable researchers (those who have worked on GM crops) was time taking, making it difficult to plan field visits which eventually got easier as they started to respond to my email that I have sent them with a brief description of the purpose of this study. However, the researchers co-operated during the interviews and answered the questions well once they engaged in the discussion.

Overall, my field experiences were quite enriching. Planning for field visits to make it productive is as important as doing it actually, is what I learnt in this research. The lessons that I learnt during this field visit will help me improve my skills as a researcher in the future.

4.6 Ethical considerations

Ethical issues are important to consider in any research. In qualitative research, the researcher's attention is on exploration, investigation, analysing and defining people and their environments. The idea of connections and power among researchers and participants is engrained in qualitative research (Orb et al, 2000).

Creswell (2014) defines the various stages of research where ethical considerations should be made and how to address those issues. Before the beginning of field work, I had sent emails to my shortlisted researchers seeking permission and appointment. It is only when the participants agreed to participate in the study after they had been elaborated on the research topic, that the data was collected both in case of researchers and farmers. The researchers were informed that the interviews are recorded and the responses will be anonymous. If a researcher wanted to read the questionnaire, it was provided to them so that the participant could chose to be a part of the discussion or not to be a part of the discussion. If the participants were not comfortable with some questions, they were free to skip those questions.

The farmers' interaction were mediated by some agencies to gain access to specific type of farmers and also to save some time. At both the study sites, the PRA exercises were organised using a pre-existing platform (Kisan Mela and Women's day celebration) and thus I did not ask them to come separately for this activity. By using these pre-existing platforms I could also ensure that the discussion starts together with all the participants so everybody gets to understand the purpose of the activity and the researcher's background. Whereas if this is done independently, gathering all the participants at one point of time is a tedious task and makes some of the participants feel bored and irritated. These farmers groups were also informed about the objective of this research and the importance of their participation. Some of the participants had to leave the discussion before it commenced due to other priorities and the PRA exercise was flexible towards this.

All the participants were thanked duly for their time, effort and cooperation at the end of interviews and PRA exercises. They were also given a chance to reflect on the activity and to share feedbacks for further improvement in future. In the rest of the process also, ethical considerations were kept in practice such as data processing, analysis, conclusion and writing of the final report.

4.7 Data processing and analysis

All the interviews were carefully transcribed by me before analysing them. Going through the interviews again definitely pointed out my own mistakes while carrying out the interviews and were a learning exercise for me. I used a foot pedal to make the task easier by leaving my hands free for typing at a faster speed.

PRA exercises which were done using big sheets were also converted into narrative text. Although we can say that these steps were taken before the analysis began, in reality, the analysis was ongoing simultaneously throughout the data collection. Miles and Huberman (1994) emphasise early analysis and they explain that by doing early and ongoing analysis the researcher can have a possibility to fill in the gaps and to collect sometimes even better data and I have experienced the same during my field work.

The analysis was done using the software NVIVO and it helped me a lot in playing with the data confidently while keeping the original transcripts intact. All the transcripts were read carefully and broken down into fragments and coded based on the themes guided through the reformulated WPR questions as discussed in chapter 3. Codes are symbols used to classify and categorise a section of text (Robson, 2002). These codes were joined together to see a pattern and make sense. Various patterns were tried before reaching the final result. While coding, some of the data was left unused if they bore no specific meaning related to any of the codes. This process is called selectivity as described by Miles and Huberman (1994) where they explain that observation as well as registration both are selective in nature and done continuously by the researcher during the entire data collection process.

I have used inductive analysis approach for this study but it was also guided by the research questions. Inductive analysis denotes basically the thorough readings of raw data to develop theories, concepts, themes or models using explanation drawn by the researcher (Thomas, 2006). In this study, after the data collection, I have gone through the data set to develop the themes by interpreting the data. An iterative approach was followed in this research which granted flexibility for the emergence of new themes from data on the basis of the research questions.

5 Findings

In this chapter the views of researchers and farmers on Indian agriculture will be discussed. Through my analysis of the interviews and PRA exercises, I will respond to the three research questions (as described in chapter 1). As the purpose of this thesis is to compare and contrast how researchers and farmers view the problems of Indian agriculture to find out the ways as well as reasons of construction of GM crops as a solution to these problems, the findings are presented under three broad sections. The researchers' and farmers' views are presented in the first two sections separately, after which they are discussed comparatively in the last section of this chapter.

5.1 Researchers' Perspective

This section will discuss how the researchers describe the problem of Indian agriculture, how do they opine around GM debate in India which includes the actors involved in the debate, changes in the debate so far (if any), farmers' suicide and distortion of facts in the debate etc. After an extensive discussion on the debate, the researchers also provided some recommendation on how the debate on GM crops can be resolved which will also be discussed here.

The researchers I met had significant experience of working with GM crops. Some of them had their own GM products or GM variety ready and yet they were struggling to see the fruit of their work in the field. The main themes of this study are how the researcher understands and describes the problems in Indian agriculture which is again subdivided in sub themes (that emerged out of the responses) such as water scarcity, climate change, poor governance of agriculture and low remuneration. Another theme that engaged researchers significantly is about the farmers' suicides in India. The next theme of findings is the purpose and relevance of GM technology which includes researchers' description on how GM technique can be an alternative to solve some of the problems in agriculture and what loss Indian

agriculture is facing by not using GM technique in agriculture today. One of the most interesting parts of the researchers' interviews was the discussion on the debate on GM crops. Within this theme I could detect sub themes relating to the actors involved and the changes in the debate, facts distortion and highlighted individual controversy in the media. The next sub theme in debate is about the suggestions made by the researchers to resolve the debate which came along during the discussion on debate but later emerged as a separate theme as they (researchers) had a very clear notion of what should be done to detangle the threads of debate. The discussion on the debate also revealed the researchers' wider perceptions on the debate in terms of e.g. if relevant topics were debated in the light of evidences or to what extent they felt that the debate was stuck in a stalemate.

5.1.1 Description of problems in Indian agriculture

Water scarcity

The problems of Indian agriculture, as described by the researchers, can be grouped into four repeatedly mentioned problems: water scarcity, climate change, poor governance and management of agriculture and low remuneration. Out of these problems water scarcity was mentioned by most of the researchers followed by poor governance and management of agriculture. Water is one of the basic inputs needed for agricultural activity. As stated by one of the researchers "In Indian agriculture, water is a major challenge". During an interview, it was said that water scarcity is due to drying up of rivers and there is nothing that can be done in this regard.

> "Water scarcity, the climate change is common to everybody in every country. If you look at the rivers, most of the rivers are dried up, that's one reason, but it is not in our hand. It is something you know, the nature has to take care of" (Researcher's individual interview, March 2019)

It was interesting to see that people from the same fraternity can have an almost opposing opinion on the same problem in agriculture, water availability. Another researcher here acknowledges that GMOs can be useful to fight the problem of climate change and water availability. As explained here:

> "Water problem is not easy to solve especially with a changing environment. A smart variety which are resilient to this, you know variations in the water condition those are the immediate need not only in cotton, in many other crops. This is a major challenge." (Researcher's individual interview, Feb 2019)

Although most of the researchers mentioned water scarcity to be one of the major problems in agriculture, they framed and envisioned different solutions to this 'problem'. Some of them also went ahead and shared their thoughts relating water scarcity with the poor coherence between the government and the scientific institutions who are responsible to work on agriculture improvement by providing infrastructural (like canal and bore well) and technical (like drip irrigation equipment and training) support for water availability. Poor coherence between governmental institutions and technical and/or agriculture institutions affects the development and implementation of these solutions. As per the researchers, even if these agriculture institutions come up with a solution, they need the government to scale it up and give it to the farmers. On the other hand, these institutions need some support and guideline to work on a solution for the water problems among the farmers, as done by other countries like Israel. As mentioned by the researchers:

> "Because the small countries Israel and all they have developed so much in terms of science and technology because (sic) they have small space, they have dessert even then they are 100 % irrigated their science is so much ahead like in hydroponics and aeroponics.... But I do not know what happened [to us] because [we] have so many institutes but I think the coherence is not there between the government and the scientific organisations." (Researcher's individual interview, Feb 2019)

Climate change

Related to water scarcity, climate change was reported as a key problem in Indian agriculture. Researchers' opinion on climate change as a problem for agriculture were divided.

> "Climate is a major problem and rain is also a problem as water deficiency is already there." (Researcher's individual interview, Feb 2019)

Although more researchers described it as a problem of the present, one researcher said that it is not a problem which needs focus now but might get worse later on. This view is not unique and can be related to leaders and researchers of other countries appearing in the media. It is important to mention here that climate change is generally categorised as a phenomenon which can be explained and dealt partially by science, yet some scientists still do not accept it. At least a denial of the magnitude of the effects produced by climate by some scientists can be easily seen in the below mentioned excerpt:

> "I don't think climate change has a huge impact right now. Maybe it can become after 10 years or 20 years maybe because of the burning fossil fuel or whatever it is." (Researcher's individual interview, Feb 2019)

So the range of opinions on climate change as a problem in agriculture exhibits wide variation. These variations can be underpinned by the discourses around climate change among the researchers having different background. However, a majority of them acknowledged that climate change is causing problems in agriculture.

Poor governance and management of agriculture

Poor governance and management of agriculture as described here includes the lack of proper storage, processing and distribution of agricultural produce, uneven nature of land distribution, lack of coherence between the government and the scientific organizations and poor policies for seed and other inputs availability to the farmers. Researchers being well informed about the agricultural performance of other countries, could easily compare different countries with India. Some of the researchers said that the post- harvest critical problems that the farmers are facing are also a result of poor governance of agriculture.

> "Our management practices are extremely poor and very bad as compared to USA, Brazil and so on. So for the same amount of land we produce less than one third of food grain as compared to those. Now there is no reason why that should happen, the only reason is in that area they grow their crops properly, they maintain their management practices and are able to make maximum use of crops' ability to produce." (Researcher's individual interview, Feb 2019)

The same researcher explains it as the biggest problem of agriculture in this way:

> "In agriculture, management is the biggest problem. We have enough food for everyone, food is not a problem as we produce enough. The only thing is that it is at different places so it needs to reach everyone." (Researcher's individual interview, Feb 2019)

The above excerpt brings a new perspective to this discussion which highlights the problem of distribution as the epicentre of food shortage as food shortage is something discussed as the basis for improvement in agricultural (productivity) by many researchers and organizations. Not only distribution, market linkage and postharvest facilities were also discussed in detail in this context.

While discussing the agriculture practices, the researchers also said that the problem of irrigation is related to the issue of poor governance. They said that irrigation

had been a problem in agriculture since a long time but due to weak governance of agriculture, no proper and adequate measures were taken so far.

> "I was talking to a person who told me that there are many management problems and nobody uses micro irrigation. They have small patches of land that are far away from the river and there is a lot of politics where wealthy people get their land close to the river and water reservoir. Every 10 to 15 years there is a redistribution of land and a person who has money gets land close to the river. So others have land but they do not have water. So that's a problem." (Researcher's individual interview, Feb 2019)

Another researcher linked the technical support and poor governance while discussing the problems of agriculture. This discussion brings the size of farm land and the capacity of a farmer to choose from among a range of seed varieties of one crop. This situation, as per the researcher, leads to a chaos as many varieties are grown in the same geographical area with varying input requirement and productivity. And since there is no support either technical or policy wise, farmers face a lot of problems. He puts it in this way:

> "The biggest challenge is that it is not farmer friendly, it should be farmer friendly. That means, with every seed package, there should be clear instruction of nutrition requirement for that amount of seed, the amount of pesticide required and other things. Because every farmer is getting the seeds on the basis of his pocket." (Researcher's individual interview, Feb 2019)

These discussions leave an impression of dissatisfaction among the researchers towards the policies formulated by the government in order to solve the problems in agriculture. In fact some of the researchers concluded that India is in need of a big policy change which would solve some of the problems that the farmers are facing today.

Low remuneration

Researchers also enlisted low remunerative prices and high cost of cultivation as one of the problems of Indian agriculture. These problems are also somehow related to the policies and needs to be taken care of by the institutions. The farmer is already facing practical issues such as water, seeds, fertilizer, herbicides and labour and all of these collectively make agriculture a low remunerative livelihood option. The researchers recognise low remuneration to be of immense importance and say:

> "The [agricultural] challenge I would say that cost of cultivation is the major problem and it should be remunerative." (Researcher's individual interview, March 2019)

This goes beyond the premises of the earlier discussed reasons and factors and stretches up to urbanization and readily available technology which is offering a comparatively steady and better remuneration in terms of other job opportunities which is gaining popularity among the rural youth as they see agriculture to be a low remunerative option. This had been sketched out by one of the researchers in an interesting way saying:

> "Yes, so the urbanization is playing a very important role and people try to come to urban area because of the medical facilities and so many facilities…….Exactly so some Mahajan [middlemen or local moneylender] will come and they will give you a very little amount of money and they will take all these things [agricultural produce]……So if you can earn good money in agriculture system…. [why would you go somewhere else]" (Researcher's individual interview, Feb 2019)

Although the problems of agriculture as described by the researchers covered some crucial points, but when discussed with the farmers, shows some contrast. Also, a constantly brought up topic in many discussion was "policies" and there lack causing problems in agriculture. The detailed comparison will be discussed in the next section of this chapter.

5.1.2 Farmers' suicide

During the discussion with the researchers regarding their opinion on the farmers' suicide which is a critical and much discussed topic especially in the Indian media, one thing was common and that was their denial regarding any correlation between the GM crops and the farmers' suicide. Some of them also denied that there is or had been any actual increase of farmers' suicide and according to them it is only a media hype.

> "This is all because of our media. Farmer suicide must have had been there always but it was not reported in the media." (Researcher's individual interview, Feb 2019)

Although the researchers shared their opinions about the absence of any correlation between farmers' suicides and GM crops, they mentioned the severity of problems that the farmers face. A range of narration could be seen in the discussion of farmers' suicide. This is what a researcher says:

> "You know in India you have a bank from where you can get the loan but people used to borrow money from local money lenders. And it creates a lot of problem because they

> have a high rate of interest…..In Bank you take this paper, sign here, your sanction will take time and in this whole process their season is going out of their hands." (Researcher's individual interview, Feb 2019)

Another discussion with the researcher yielded yet a different perspective on farmers' suicide. One of the researcher is explaining why the cash crop growing farmers were worse affected:

> "The farmer's suicide mainly occurred in Gujarat Maharashtra and partly in Punjab and some parts of Andhra Pradesh which are prime growers of cotton. The cotton crop was highly susceptible to ball worm in South India and whitefly in Punjab. Merely spraying insecticide didn't work. The farmers purchased the insecticides mortgaging their land and mortgaging jewelleries of their wives. They made huge sacrifices in purchasing these insecticides and pesticides. And even after spraying they could not control the insect and the whole crop was devastated. Ultimately they were penniless." (Researcher's individual interview, Feb 2019)

Most researchers pointed out that there are loopholes in the policies and these discrepancies contribute towards the farmers' distress. As put by one of the researchers:

> "The thing is that the agriculture is still rain fed and policies are still not in place to ensure that the farmers get electricity and water." (Researcher's individual interview, Feb 2019)

In the media, costly seeds of Bt cotton were accused of doubling up the input cost and putting the farmers under immense pressure which was somehow mentioned as one of the reasons of farmers suicides which is generally denied by the majority of researchers. The views of a researcher on this whole controversy with governments' role in it is like this:

> "Yes that is there. But why are the prices so high. For example, Monsanto, Mahyco were the key player in case of cotton. What they did is that even after earning a profit, they had fixed or kept the price at 500 (Indian Rupees) (for a bag of seed which is many times more than the usual seed) then why was the government sleeping? They had already earned their share of profit in 10 years and the patent was also over in 10 years but still the government did not play role. Now they have taken it up which you should have done long ago." (Researcher's individual interview, Feb 2019)

The above excerpt shows that even though the researchers are saying that there is no reality in the farmers' suicide news as flashed in media they still blame poor governance of agriculture as an overarching issue for the farmers' plight in the

broader sense. Although they added that the technology *per se* is good, the knowledge, logistic and managerial competencies that is required for it, is a little costly for the farmers.

> "GM crop can never be non performing….It was non performing because it was there for a certain disease or insect but it cannot tackle the attack of some other insect. For that you have to spray the insecticide and that needs the investment. The farmers did not know that it can only tackle one insect. The seed sellers claims that no insect will damage this. So they are making fool of these farmers." (Researcher's individual interview, Feb 2019)

In the discussion with researchers what was common that they all exhibited their complete faith in the GM crops and denied the performance of a GM crop being directly responsible for the precarious state of GM farmers. However, the researchers give different priority to the suicides and attribute them to slightly different reasons spanning from lack of pro farmer policies to weak institutions, but that none of the researchers see GMO *per se* responsible for it.

5.1.3 GM crops as a solution for agriculture problems

The main focus of the entire interview with researchers was to understand how they define the problems of agriculture and how do they justify the solutions especially GMOs, that they propose and advocate, to solve those problems. In the course of the discussion, the researchers described their reasoning of coming up with the GMO solutions that would help to solve some of the agriculture problems. Their opinions on this topic varied from saying that GMOs as one of the most important solutions to combat agriculture problems to suggesting or rather admitting that GMOs can be treated as an alternative in a few cases. Here are some excerpts from the researchers' interviews which shows the spectrum of opinion.

> "To be very honest if we do have these post-harvest Industries and other management options then there is no need of Gene Technology to improve. ….you cannot have a solution for everything you have to keep moving with the changes in the environment. We can have Gene technology as a solution where we do not have other options." (Researcher's individual interview, Feb 2019)

> "I am always pro GM and I advocate for that and I write for that but I think there are certain things that breeding cannot do and GM can always do it. Like GM can enhance productivity, GM can help plant to adapt to different stress conditions. I think in coming

> years India should realize those conditions and RCGM should come with some positive mind so that varieties can be released." (Researcher's individual interview, Feb 2019)

Some researchers said that they believe that GM technology should be used in combination with other available options. As one of the researchers said "for each and every thing you cannot go for GM, there are other alternative technology".

Looking at the description of problems of Indian agriculture we can infer that most of the problems discussed by the researchers' needs policy adjustment to tackle them but when asked about the GM technology, they also tend to favour the use of this technology. However, the researchers seem to be aware of the current challenges that needs to be taken care of by policy adjustments and other measures.

5.1.4 GMO debate in India

The GMO debate in India is something that the researchers are quite informed about. In this section I will discuss the researchers' opinion on the GMO debate in India which includes the actors involved in the debate, changes in the debate so far, the biggest GM controversy and distortion of facts in the debate. At the end of this section, suggestions by the researchers is discussed.

Involvement of actors and changes in the debate over the time

When asked about the actors involved in the debate, most of the researchers said that the actors are basically the NGOs, government or politicians, GM scientists, private agro chemical companies, media and the public.

> "Organization, particularly NGOs play big role in negatively propagating the ideas of GMOs, then scientists those who are not vocal most of the time, then government that has to depend on the inputs that it gets and decides the policy as per the pressure on it from these people and of course the industries, and the perception of the industry by the people, agrochemical Industries and Seed Industries they have a stake in the GMOs but then they are also dependent on the public perception for them to invest money, these are the main players." (Researcher's individual interview, Feb 2019)

Some of the researchers went a step ahead and already divided the actors in pro and anti GM regime. This exhibits the perception about how polarized the debate is.

> "Other than scientist I think anti GM people, like Greenpeace and other things, activists. Apart from scientists I don't think that there is anybody who's talking pro GM." (Researcher's individual interview, Feb 2019)

One of the researchers said that people with the least knowledge or authority over GMO are the most prominent in the debate. This was said while discussing the role of media in the debate. The researcher views in this context are:

> "Typically those who do not know anything they are only talking, they only decide the fate of things. So that is very unfortunate." (Researcher's individual interview, March 2019)

From among the list of actors that the researchers identified, activists and NGOs, media and private agro chemical industries were the most discussed ones. The media had not been very helpful in resolving the debate rather it had been fuelling to make it worse by "blowing things out of proportion". They also said that the activists and the agro chemical companies have been prominent in the debate.

> "[....] against (GMO) are basically the activists backed up by the insecticide and pesticide companies." (Researcher's individual interview, Feb 2019)

Researchers worried about the continuing public lack of acceptance of GM as they felt that the GM debate has become more rather than less polarized. It was discussed in the context of people having a tendency of getting more scared when they have various yet ambiguous information from different sources. In this scenario, people usually tend to leave the GM food since they have heard so much about it and can't decide if they should use it or not. The researchers' perception was that people go with organic food (if they can afford it) rather than GM food which has both positive and negative accounts attached to it. According to the researchers:

> "Earlier people were not very knowledgeable about transgenics one or two decades ago but they are more aware (now) [….]. People are preferring organic food and GMO technology is not preferred [….]. Knowledge has become advanced and people have become more against GMOs." (Researcher's individual interview, Feb 2019)

The researchers were very confident while sharing their views about the actors involved in the debate. They also shared their respective roles and elaborated about how it effects the GM debate. Most of the researchers were not hopeful regarding the debate and said that it does not seem to resolve anytime soon. They also mentioned that it is not only about the credibility of the technology but it involves business and politics making it too complicated.

Facts distortion and highlighted individual controversy in the media

Almost all the researchers appeared to be complaining about the facts distortion by the various actors about the GMOs. It is an inherited nature of a researcher to give immense importance to the facts and figures while discussing something. Therefore, presentation or use of facts in the media in a distorted way, seem to have upset the researchers. When they were asked about their opinion on facts distortion or any personal experience of facts distortion regarding the GMO debate in India, one said:

> "Most of the statements published in newspapers or electronic media or social media they are all baseless. There is no base, anything and everything is business. Like I have seen a plate with apple and there was a syringe with poison written on it and it is (being) injected. Bt technology doesn't work in this way." (Researcher's individual interview, Feb 2019)

The researchers had various incidences of facts distortion in case of the GMO debate. While some said that it is due to the lack of information, some said that it is a deliberate act by the media since they can gain publicity by showing baseless and false scary images repeatedly.

> "[….] a big player in this is the media who will normally not try to highlight the good things they like to make things scary" (Researcher's individual interview, Feb 2019)

The distortion of facts by the actors makes it hard for the public to decide which facts to believe and which not. This leads to an even bigger chaotic situation where the decorum of the debate which includes the use of proper facts and figures is violated.

When researchers were asked about their opinion on the activities and statements by Vandana Shiva, they were mostly linking her with facts distortion and said that she does not have any liability towards what she says as compared to the scientists who has to be very careful about what they say.

> "Debate is good. Everything has its pros and cons but nearly discarding a technology by saying that it is against the society, it is very costly, it's not effective is not correct." (Researcher's individual interview, Feb 2019)

The researchers deliberated on having a fair debate with her openly to make sure that both the parties can speak their minds and educate each other about the facts and figure and resolve the debate. This shows their faith in facts and figures which is probably due to the nature of their work. Another interesting observation that

comes out of this conversation is that despite many past comprehensive debates between Vandana Shiva and agriculture scientists, they are still hopeful that another "proper" debate would able to help in settling this.

Also, Dr. M. S. Swaminathan and the recent episode of a controversy involving him (described in chapter 2) was discussed with the researchers. When asked about their opinion on his controversy, as someone from the scientific fraternity exhibiting some negativity through a paper on GM crops, they said that this whole episode was unfortunate and they feel bad about it. Some researchers even hesitated to comment on this controversy saying that he is a big name. Yet one said:

> "Very sad. I don't know is it age effect or whatever or the other fellow didn't inform him and just put his name and he said yes. Later on he retracted his name. We did not expect this because initially he had favoured this technology. That created a problem and everybody started to comment." (Researcher's individual interview, Feb 2019)

These two are the examples of individual controversy in case of the GMO debate which has their strings attached to facts distortion. There are other examples as well of individual controversy such as Dr. Gilles-Éric Séralini, a French scientist working on GMOs. All these controversies shows that the controversies are usually based on one's interpretations of people's work, thought, behaviour and speech etc. These interpretation diverge from person to person and it is the same in case of GMOs where a number of people with interdisciplinary backgrounds are involved in the debate with their own interpretation of the issue. Overall, the researchers had a strong opinion about the baselessness of these controversy and seemed to be unhappy about the way these controversies flashed in the media reaching many people making them scared and misinformed rather than providing a platform for the discussion of GM pronouncing its prospects as well.

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The iterative nature of my study allowed me to engage in discussion which I had not planned earlier and to identify it as a theme and make room for the discussion of this emerged theme in my thesis. Despite the fact that this topic was not part of my questionnaire, most of the researchers shared their views on what they feel can help to resolve the debate.

The most important point which almost all of the researchers raised that they feel is missing in the debate was "communication". Some of them even agreed that they feel that the communication part from their side is missing especially with the farmers.

> "[…] we work in the lab with our students and we do not have that much of time and energy and platform so that we can interact with everybody like the farmers. How does these companies get their product sold? They advertise and pump lots of money in the marketing and advertisement. What do we do? We just do our work and we keep on sitting for the government's approval or the extension job will be done by the scientist of extension division. We cannot go and communicate with the farmers." (Researcher's individual interview, Feb 2019)

Apart from the farmers they also acknowledged that a common platform for direct communication with other actors for a fair debate is missing which could have otherwise helped to detangle the threads of this GMO debate. As put by one of the researchers "There is a need to have a platform, common platform". Another researcher also emphasised involving all the stakeholders in the debate and allow them to present their facts while mentioning in particular the farmers as they are least involved. Here is an example of a similar discussion by one of the researchers who would like to have a debate where everyone can present their facts. This seems a good and logical idea to resolve the debate yet it shows that a researcher after all believes that given a chance, "their facts" will prove the truth and worthiness of GMOs thereby resolving the debate.

> "Let's have a proper debate. …That should be of 3 to 5 days complete conference. So that everybody should have a chance to speak. …I will also present my facts, if you have got some facts then you can come and share them and the farmers should also come and present their facts." (Researcher's individual interview, Feb 2019)

Another important point raised was that researchers need more support from the members of the regulatory and approval committee in resolving the debate. This part was not discussed by most of the researchers rather majority of them didn't say anything about their need of learning in case of GMOs but here one of the researchers mentioned that if the regulatory/ approval committee is looking for something in particular, it would be good if they can inform the researchers to know about how they can improve, this will help them to come up with a more acceptable and less doubtful products and will also shorten the time which is usually very long in a normal course of a GMO product approval. To conclude the suggestions of researchers to resolve the debate it can be said that communication, right information and political will is what the researchers look up to at this stage for this long awaited debate on GMOs to put to an end.

5.2 Farmers' Perspectives

In this section I will discuss the farmers' perspectives on the problems that they are facing. There were two groups of farmers that I interacted with. First, farmers having no experience of GM cropping and second, farmers having experience of GM cropping. These two groups were geographically distant from each other, one in north and other in south of India. They shared completely different conditions in terms of climate, culture, politics, language and agriculture practices.

Figure 2. PRA exercise with the non-GM farmers

5.2.1 Farmers having no experience of GM cropping

Context of non GM farmers

The farmers whom I interacted with were from the nearing villages of Lucknow, the capital of Uttar Pradesh, a state situated in northern India. They were mostly small and medium farmers with the average land size of 2.5 to 5 acres. These farmers did not have any experience of growing any GM crops since they come from a state where the government never allowed GM cropping.

A brief discussion was done before problem ranking to understand the context of these farmers and agriculture scenario in that area. The farmers shared the story of agricultural changes from 1950s till now. The farmers shared that they have experienced many changes in farming so far but the main crop at the centre of all was sugarcane, a cash crop. Their shift from subsistence farming to cash cropping and improved irrigation facility was marked as a milestone in the changes in agriculture.

The changes from bullock cart with wooden wheels to bullock cart with rubber wheels and finally the use of tractors was one of the major changes in terms of farm equipment. But it did not trigger as big change as the introduction of sugarcane did. As the farmers said, in the beginning, sugarcane used to fetch good money but later due to delay in payment, this became of less interest and so other options were explored by the farmers. This delay in the payment is a policy problem as it took a long time for the remunerative money to reach the farmers from the concerned government department. This disappointment led them to look for farming of other crops which were wheat, rice, pulses, potato and other local seasonal vegetables. In almost all the major changes that were discussed by the farmers, policy changes and government's support to implement it, can be seen as a reason of success in the change. While talking about the present scenario, the farmers seemed to be unsatisfied and said that they are looking for other options of livelihood and income. This is basically because of the multiple folded rise in the input cost in agriculture making it less remunerative and insufficient for them.

Problem ranking with non GM farmers

This PRA exercise was done with the aim of understanding the problems of farmers and to prioritize them to know their needs. Later this list of problems was compared with the researchers' perspective on problems in agriculture to see how well these problem descriptions are corresponding to each other. The farmers first discussed about the various problems that were important to them and then later we tried to prioritise them based on their severity. A list of ten problems emerged at the end. The most important problems that the farmers in Lucknow are facing was water availability. It can be understood more clearly if we see the second problem in the list which was about the irregularity of electricity as they need fixed and announced hours of electricity for the water pumps for irrigation in the fields.

The third problem was crop loss due to big animals such as cows and pigs. They said that it takes a lot of time and energy to keep an eye on the entire field for the whole day especially in the peak seasons of summer. The third biggest problem for them was plant diseases. Although they could not describe any specific disease, they emphasised diseases as a main agricultural problem. The distance of market was the fifth in order, which added up in the input cost and created the conveyance issue for the transportation of the agricultural produce to the market. Due to the long distance, they need to plan accordingly and could not wait much to get good prices for their produce. The next problem is related to the problem of market as it is the problem of small farmers to sell their produce. What they explained here is that the small farmers face difficulty in selling their produce as they often need to wait for the conveyance options available in the village which will give priority to the large farmers and also the prices fixed by the whole sellers in the market is not appropriate

for the small farmers owing to the difference in cost of cultivation by the small and large farmers for the same crop, fruit or vegetable. This means that these small holder farmers have less negotiation power.

The problem of fertilizers was brought up by the farmers on the seventh position but they emphasised it a lot. Farmers said that they did not use any kind of fertilizer earlier but gradually they started using approximately 25 kg of fertilizer for one acre of land then it doubled to 50 kg approx. for one acre of land to a point when they used 100 kg of fertilizers for one acre of land. The farmers said that fertilizer consumption not only added to the input cost but also deteriorated the soil quality. Their major concern was that in the present scenario, they were using heavy amounts of costly fertilizers while it is failing to give the expected results and the crops production has weakened.

Right after the fertilizers, the problems of insects and pests was discussed by the farmers. The main insect they described was targeting rice and pulse grains which are some of the most important food crops for these farmers and are the staple food in that area.

While discussing the changes in farming during the trend analysis of agriculture, they also shared their feelings about the changes in the village society. They said that the issue of labour is more of a social issue than a monetary one. The reason why it is like that can be understood by the farmers' explanation when they say that in the earlier times "we all helped each other for labour" but now days labour has become very expensive and "nobody helps each other as the thinking and priorities have changed". The issue of youth migration for better and more livelihood opportunities in the urban area has also attributed significantly in this regard as per the famers.

Lastly, the farmers said that agriculture has become less remunerative as the cost of cultivation and other input costs have gone up as a cumulative result of all the above mentioned problems. This problem description by the farmers shows that they are facing a bunch of problems which can be categorised in firstly, problems which can be solved by more science and secondly, problems which can be solved by policy changes.

5.2.2 Farmers having experience of GM cropping

Context of GM farmers

The GM farmers of this study are from the southern part of India. They are small and medium share holder farmers with land size between 2.5 to 5 acres. The farmers were more educated in this part of India as they were writing on the papers by themselves and the women were very interactive and were able to read and write without any hesitation. All of the farmers in this group had grown Bt cotton at some point

and were well aware of the pros and cons of GM crops. We did not specifically talk only about Bt cotton as they seemed more comfortable when they were talking about agriculture in general rather than confining the discussion only about Bt cotton. The reason I could interpret is that they, as farmers, could describe their feelings and views more easily and comprehensively if they are talking about all of their crops than just talking about only one crop, Bt cotton.

Like non-GM farmers, here also a brief discussion was done before problem ranking to understand the agriculture scenario. These farmers gave immense importance to the fact that earlier they used to grow many types of crops including millets, pulses and spices. Tools and equipment used were same as in case of non GM farmers as they also started with bullock and ox for farming activity and now they are using tractors. As per the farmers they have witnessed a dramatic change in the type and quantity of the fertilizers used which was also quite similar to the non GM farmers. They also shared their concern that due to the heavy use of fertilizers, they feel that it causes health hazards on their family which ultimately decreases their capacity to go for the labour intensive agriculture work.

They shared their story of changes in agriculture in their area since 1960s. They elaborated on many things like – crop variety, number of crops cultivated in a year, tools and equipment used, type and quantity of fertilizers, irrigation facility, seeds availability, minimum support price, rainfall, labour arrangement and crop loss.

Seed availability has also changed tremendously as per the farmers as they said that earlier they were able to save and produce the seeds by themselves but now, they must buy the seeds from the market based on their budget. This can be understood clearly as they were Bt cotton growing farmers who need to buy seeds from the market for every season. Now they are only growing cash crops basically cotton, turmeric, maize, onion, pearl millet and red gram cutting the list of more than 25 crops grown earlier to less than 10 crops now.

Problem ranking with GM farmers

An extensive list of problems were prepared with these GM farmers which included seventeen points. After going through this again, they prioritized them based on their severity just the way the non-GM farmers did. The first three points were related to water availability as they were about lack of rainfall, lack of water resources and less trees resulting in less rainfall. Climate change was also discussed which according to them played a key role in changing the agriculture pattern in their area. They said that earlier they were dependent on the rain for irrigation and the rain was regular and adequate but later either heavy rainfall or less rainfall has started to cause problems in agriculture. To solve this problem they started using canals, tubes and pipes, bore well and wells but later on they shifted to drip irrigation as it does not need labour and reduces the water loss but still they are facing the problem of

water availability as drip irrigation is a little bit costly and needs proper planning and technical support for best performance in the field.

The next important point was that wheat, rice and millets are attacked by birds and other animals which leads them to opt cash crops such as cotton since they are not consumed by the animals. Minimum support prices (MSP) came on the fifth position in this list as they said that they were not sufficient. Another important problem for the farmers was the lack of proper storage facilities. In case of grains and vegetables, they often face post harvesting loss as they do not have storage facility for their agricultural produce. The problem of proper market facility was the same as raised by the non GM farmers. Furthermore, insufficient credit system was also mentioned by these farmers as they said that it is "difficult to take loans from the bank". Another policy related problem right after the credit problem was about lack of awareness about the crop insurance. They said that due to heavy and less rainfall, they are facing the problem of crop loss but they have little knowledge about the crop insurance which is also usually insufficient. Mono cropping was a unique problem mentioned so far as it was not discussed by the previous group of farmers.

Figure 3. PRA exercise with the GM farmers

The farmers said that it leads to loss in the soil productivity and loss in the crop diversity in their area. They also mentioned lack of soil testing facility later in the list which is related to this mono cropping issue. Weather forecast fails to provide assistance to the farmers in proper planning and results in the crops loss. This was discussed by the farmers in relation to the apps that are known to the farmers such as weather forecast and market rates or MSP etc. but they have not yet used them as

these apps are either not launched in that area or needs more technological knowledge among the farmers to be used. Farmers also raised their concern toward the use and dependency on chemical fertilizers as they said that since they own less livestock, it creates a dependency on the chemical fertilizers. The last point on the list was pollution of land and water resources by the industrial waste as this causes health hazards for them.

All the above mentioned problems were discussed in detail by the farmers with suitable examples. This list gives us a possibility to categorise it in problems that can be solved with more science and technology, problems which needs policy change and rest requiring social awareness for a solution. This problem articulation by the farmers will be compared with the problem description by the researchers' to see how well they are aligned with each other in the next section.

5.3 Comparing and contrasting the views of farmers groups and researchers

A comparison of views expressed by the two farmers groups, GM and the non GM farmers is done in this section in addition to the comparison of views of the researchers and farmers group (as a whole) to see their alignment with each other on the issue of "problems of Indian agriculture" and also to see in what ways do the researchers construct GM crops a solution to some of these problems.

5.3.1 Comparison of the views of both GM and non GM farmers groups

The two farmers group, GM and non GM farmers shared their views on the changes in the trend of agriculture so far and the problems that they are facing today in agriculture. These farmers groups are facing a different set of problems. A reason for this variation could be their engagement in the different types of agriculture for example in terms of GM crops, in addition to their educational and cultural background.

Both the groups raised water availability as the most important problem in agriculture. But the problem of electricity was only discussed by the non GM farmers as the GM farmers in south India have better electricity supply and have also shifted to drip irrigation in many places owing to many benefits attached to it. The non GM farmers' problems description were more a reflection of their daily struggle such as market distance and low prices of their agricultural produce whereas the problem description of GM farmers were pointing towards policy and technological issues such as MSP discrepancies, poor weather forecast and lack of proper storage facility. Another clear difference between the two groups was that the non GM farmers

had smaller sized farms and were less market integrated than the GM farmers. This showed clearly in the problems they pointed out. The non-GM farmers thought that they got too little pay for their products, but this was not pointed out by the GM farmers. It was also clear that the GM farmers were more knowledgeable about the policies and available agricultural support structures, and had good knowledge of various farming technologies such as irrigation from canals, pipes and drip irrigation. These GM farmers also discussed the problem of mono cropping, in particular its adverse effect on the soil quality. The absence of soil testing facility, poor performing weather forecast system and other helpful apps were discussed by the GM farmers in detail but were not raised by the non GM farmers who also face the problem of rain, cyclone, drought and MSP.

Table 1. *Comparison of non-GM and GM farmers' 'problematizations'*

	GM farmers	Non-GM farmers
1	Water scarcity for irrigation	Lack of rainfall
2	Lack of proper electricity as there are no fixed and announced hours of electricity which is needed mainly for irrigation	Lack of water resources e.g. ponds, canals
3	Crop loss due to big animals such as pig, cows, cats	No trees leading to less rainfall and soil erosion
4	Crop diseases especially in wheat	Crop loss in case of millets and cereals due to birds and monkeys so they prefer cash crops like cotton to avoid this
5	Crop loss in case of millets and cereals due to birds and monkeys so they prefer cash crops like cotton to avoid this	Insufficient MSP
6	Distance from the market	Lack of proper storage facility
7	Difficulties in selling agriculture produce especially for small holder farmers	Lack of proper market
8	Heavy fertilizer's expenses and yet they perform poorly sometimes	Pest attack (e.g. pink ball worm in cotton)
9	Pest attack	Difficult credit system
10	Cost of transportation	Lack of awareness about crop insurance
11	Low remuneration	Crop loss due to heavy/less rainfall
12		Mono cropping leading to poor soil quality
13		No awareness about new apps and technology
14		Soil testing facility is lacking
15		Lack of timely and accurate weather forecast to take safety measures
16		Less livestock leads to more dependency on chemical fertilizers
17		Pollution of land and water by the use of fertilizers and industrial waste

These points were absent in the discussion with the non GM farmers indicating that the GM farmers have had access to more agricultural training, access to extension services and are more integrated into markets. Pest and animal attack, fertilizers and labour are three important issues discussed by both the groups although in varying degree. The GM farmers not only discussed their problems, they were also worried about the nature and the society as they mentioned the harmful effects of fertilizers on our health and the pollution caused in water tables. This was not discussed to this extent by the non GM farmers as they seemed to be fighting with the day to day issues and at last they concluded the discussion by saying that they are now looking for alternative livelihood options to sustain themselves. This was not the same for the GM farmers who did not seem to have lost their hope in farming, although they point out that they need solutions to some of the enlisted problems to perform better.

A comparison between these two groups starts with this interesting fact that the non GM farmers used to grow only one crop and later they started off with more and more crops in one year whereas the GM farmers said that they used to grow many crops in the beginning but now this list is not even a one third of the previous one. Both the groups acknowledged that they have gradually started to use more and more fertilizers which adds up to the input cost. It is also important to point out that despite almost same decades of farming era, both of these farmers groups now have entirely different irrigation facilities. The non GM farmers are still struggling with irrigation using pumps, pipes and tube well whereas the GM farmers have shifted to drip irrigation which is an advance system of irrigation. The steady availability of electricity in the area of GM farmers makes drip irrigation as an alternative which is missing in the non GM farmers. One of the reasons suggested by the GM farmers for the shift to cash crop or Bt cotton was that it was less input intensive and more protected by the animals and pests which leads to less crop loss but the non GM farmers do not have another option yet to look to despite them struggling with the similar problem.

5.3.2 Comparison of researchers' and farmers' perspectives on agriculture problems

The researchers' and farmers' problem descriptions are discussed and compared in this section to find out if and in what way they correspond to each other. As described above, the researchers tend to emphasise inappropriate policies and poor governance and management of agriculture as key reasons for most of the farmers' problems, whereas the farmers, by and large construct their problems as mainly practical and technical problems that they face in their everyday work. What can be

concluded from these constructs is that neither the farmers nor the researchers emphasise problems that can be solved only by GM crops, and that the researchers usually look at the larger picture of farming whereas the farmers focus on everyday challenges. It is particularly interesting that the researchers who are developing GM crops are still not emphasising the kinds of problems that GM crops can solve as key problems in Indian agriculture. As some of the researchers pointed out, there is a communication gap between farmers and researchers and that farmers are seldom heard in the public debate.

Some problems were listed by both the researchers' and farmers', yet the way they were described was different. For example, the first and foremost problem which appeared in both the narrations was water availability, but the farmers described it as a result of less rain or climate change and cutting trees whereas the researchers emphasised the lack of appropriate policies and pointed out that other nations enforce more effective policies for irrigation and have better infrastructure and institutions supporting farming.

Researchers' description about the problems in agriculture and their own narration about the justification of GM crops as an answer to solve problems in agriculture does not fit perfectly. This is apparent from the dialogues around "how can GM technology solve these problems" where the researchers who earlier explained that many of the agricultural problems are a result of governmental flaw, yet they think that these problems can be solved by the use of GM technology, if given a chance. The point to notice here is if there are insufficient pro farming arrangements, how the researchers can be sure that the GM technology (which is relatively more complicated and needs thorough training) be implemented or governed without proper guidelines and policies in place.

In some of the parts of discussion with the farmers it appeared that they are looking towards the technological support for example apps to help with weather forecast, MSP and marketplace which are already available in some parts of the country or at least in the agricultural extension offices and agricultural universities and institutions. If these simple facilities and technologies are not able to reach their beneficiaries, the farmers, then the whole justification of the researchers', on the other hand, about GM being able to solve the farmers problem does not make much sense.

Some problems that were shared by most of the farmers, like lack of transport to distant markets and difficulties in accessing credit were discussed only a little by the researchers which also indicates that the researchers might not be so well acquainted with the farmers' problems. Input cost was also discussed in detail with both the researchers and the farmers and it was found that both the groups were on the same page on this issue. They both agreed that the seed and fertilizer costs had gone up, especially the seed cost in case of Bt cotton (but also in other crops such as wheat and rice), making agriculture less remunerative.

An overall conclusion for both the narratives could be that the researchers and the GM farmers to some extent focus more on policy and infrastructure problems whereas the non GM farmers focus on their day to day struggles. Also, the researchers do not always have a good insight into farmers' day to day struggles and problems. An important point to notice was that neither the researchers nor the farmers prioritise problems that can be solved only by the use of GM crops.

6 Discussion

In this chapter a discussion on the interpretation of researchers' and farmers' 'problematizations' is done to see how well they fit with each other. I will also suggest some probable underlying assumptions for these 'problematizations'. Here I will try to compare the researchers and farmers perspective with the available literature to find out the assumptions, silences and gaps in their 'problematization' (cf. Bacchi, 2009). The focus of this chapter is to understand how and why the researchers and farmers 'problematize' Indian agriculture in a specific way to see the reason behind the construction of GM crops as a solution based on these 'problematizations'. A brief discussion on the polemics of the GM debate, as put by the media, will also be done here as media had so far played a major role in constructing and reinforcing discourses related to the GM debate.

6.1 Extent of correspondence or dissonance in the 'problematization' of researchers and farmers

In the previous chapter, a comparison of the views of researchers and farmers on "problems in Indian agriculture" was presented. The analysis of these narrations illustrates that farmers' and researchers' 'problematizations' are different from each other. A possible reason for this deviation could be different discourse(s) guiding their respective assumptions (Bacchi, 2009) and also their respective material circumstances such as the effect of soil quality, when and how much rain comes, market prices etc. Farmers 'problematized' agriculture mostly on the basis of their own local experiences and knowledge of many years spent in agriculture creating a certain discursive context for them. The analysis indicates that the farmers are not particularly influenced by the media or researchers in how they frame their problems, but their 'problematization' is strongly based on the actual material problems they experience. Especially the non-GM farmers seemed only to a limited extent knowledgeable of the wider policy landscape influencing their farming (and possibly they

were also less directly affected by this as they to a higher degree produced for subsistence than the GM farmers). In contrast, the researchers' 'problematization' is clearly more influenced by the wider discursive landscape, e.g. by their interaction with policy makers, what they read in the media etc.

The researchers acknowledged that they should communicate more to make the farmers aware about their work and the solutions that they are coming up with. Yet, the urge and importance of communication seemed less in learning from farmers about the problems they are facing in agriculture. Bacchi (2009) says that the "problem representation" needs to be critically analysed in order to identify the presuppositions and assumptions of that particular 'problematization'. The observation made in this study does not indicate that the researchers are completely unaware of the agricultural problems that farmers face, or are unwilling to know about these problems, but it shows that the researchers might not realise that it is important that they also listen to the farmers.

To understand how discourse plays an important role in 'problematization' in the context of this study, let us take an example. Even though the farmers and the researchers both prioritize the same problem "water availability" as the most important one, they categorize it differently. Approximately, 56 % of the total cultivated area in India is rain fed agriculture (Suresh et al, 2014) and thus there is an evident need to ensure irrigation in the fields. For the researchers and GM farmers, the policies and infrastructure were mostly responsible for this problem but for the non GM farmers, they saw it as their daily struggle. This difference in these elaborations could be explained by the discourses which allows or restricts them to question or criticise the concerned policies.

As the bearer of these discourses the researchers go ahead with their 'problematization' and link this problem with the current and past agricultural policies of not only India but other countries such as China, USA, Israel and Brazil. This linking and comparison of policies by the researchers can be seen in a number of articles discussing Indian agriculture. For example, Shetty (2014) and Kumar (2014) have mentioned agriculture in other countries while discussing India's agriculture primarily. These articles discuss the milestones of innovations that shaped agriculture, and climate change and its impact on agriculture respectively, comparing the aspects of yield productivity, investment in agriculture research, development of hybrids, food consumption (as an argument to raise food production) in India with some other countries. This is worth mentioning here because we can see that since the researchers' are well versed with the global advancements and news, they use this discourse while 'problematizing' Indian agriculture. It is appreciable that these researchers are trying to learn from other countries but a more appropriate and urgent step would be to listen to the farmers of their area to be able to apply some of these appropriate solutions learnt from global lessons efficiently.

Like the researchers, the GM farmers who are more market integrated were problematizing agriculture with emphasis on market and policy issues. But if we look at the non GM farmers, they mainly emphasised their daily struggle without linking it further to the policy landscape, for example how policies were designed differently or there was better access to infrastructure in nearby states. Although it is difficult to say if these non GM farmers were unaware of other pro-agriculture policies and facilities available in other parts of India, at least it is evident that these types of comparison and linking did not come naturally when the non-GM farmers listed their problems, unlike by the GM farmers and the researchers. The point I am making here is that not only the 'problematization' but their underlying details also tell a lot, which should be taken into account to carve a more meaningful picture. This complements what Bacchi (2009) also emphasises, which is on the importance of perspective in the discussion while 'problematizing'.

Farmers emphasised that a major problem for them is that agriculture is less remunerative nowadays and said that because of this, they are losing interest in farming and look for alternative livelihood options. This problem was also listed by the researchers and discussed in detail. It was further dismantled during the discussions to understand the views of farmers and the researchers on this topic and showed that farmers and researchers both "problematized" it nearly likewise. The researchers' focus were around the middlemen and urbanization leading to less and costly labour and ultimately making agriculture less remunerative. The farmers discussed it as a cumulative effect of all the problems discussed emphasizing the unsatisfactory MSP (expected role of MSP is to provide guaranteed protection against price fluctuations and market imperfections to the farmers), input cost for water and fertilizers and market related problems. The way the farmers and researchers have described the problem of less remuneration in Indian agriculture is partially similar to what NITI aayog (National Institution for Transforming India) a Government of India institution, has reported which presents a very detailed analysis of this problem. NITI aayog, Government of India (2015) summarised the various factors that may attribute to make agriculture a low remunerative option for the farmers. These reasons include poor supply chain, large number of intermediaries, inadequacy and irregularity in MSP, perishable and localised nature of some products such as fruits etc. (NITI aayog, GoI, 2015). Weighing all these three 'problem representations' of less remuneration by the researchers, farmers and the government indicates that different actor groups made different 'problematizations' based on their varying wider discourses and material needs and interests. It also shows that in addition to the 'problems' that farmers and researchers point out, the government adds some more problems, which can be seen as examples of gaps or silences in the farmers and researchers 'problematisation'.

It becomes clear with this discussion of low remuneration that none of the actors study take in all the aspects included in the problematization of another actor. Thus, none of the actor groups', despite their degree of involvement in agriculture, seem incapable of supplying a full picture. Bacchi (2009) explains that analysing 'problem' using WPR helps to point out the tension and contradictions in the 'problem representation' highlighting limits and gaps. The above text regarding the 'problematization' of less remuneration shows an example of finding silences and gaps.

6.2 Construction of GM crops as a solution based on these 'problematizations'

Bacchi (2009) suggests that analysing a 'problem representation' critically can lead to a refined problem understanding and the identification of how different solutions are to the benefit or detriment of different groups in society. The GM debate is an example of such a situation where the debate has been going on for decades, mainly amongst other actors than farmers, and largely has focused on other issues (e.g. moral issues, food safety etc.) than if and how GM crops can be of use for farmers. The use of WPR in this study urges us to change focus in the GM debate. Looking at the GM debate from the WPR lens indicates to us that the problems that farmers see as most acute are not the ones solved by GM crops but by changes in agricultural policy, but at the same time that GM crops can provide partial solutions to some of the problems faced by farmers. This is similar to what Tripp (2009) suggests, that there is a need for shift in focus from considering transgenic crops merely as a technical answer towards the institutional challenges, which decides the way this technology is going to be used while evaluating these transgenic crops.

A comparison of the 'problematization' of agriculture by the researchers' and farmers' infers that neither researchers nor farmers clearly prioritise the problems in agriculture which can be solved only by using the GMOs. In an ideal condition, for GM to be constructed as a solution, the 'problematization' of Indian agriculture should have been in such a way to list out the problems where GM is an obvious and exclusive solution for at least some of the prioritized problems. However, the researchers acknowledged the need to consider other solutions to the agricultural problems which they had listed. Improvement in agronomic practices, strengthening institutions, technical and infrastructural support and appropriate policies were discussed by most of the researchers interviewed in this study and they agreed that GM should be treated as an integrated solution in the broader agricultural context. This is somewhat similar to what Tripp (2009, p. 243) concludes while discussing biotechnology and agricultural development that "there is a long list of recommendations" for sustainably reducing poverty among small holder farmers. Here he also

says that introducing new technology can definitely contribute in the reduction of poverty amongst small holder farmers, but there is a dire need for the development of local institutions. The GM farmers indeed appreciated GM crops, Bt Cotton in this case, but despite using one of the GM varieties, they are still facing a number of agriculture related problems. This relates to Tripp's (2009) conclusion which demands for much more than just GM crops to solve the farmers' problems.

The features of strategic framing could be traced out easily in the researchers' 'problematization'. Strategic framing means deliberately positioning logics around an issue in order to favour it. A notion of deliberation peeked through while constructing GM as a solution to the problems of agriculture. The reason why researchers propose and supports GM is obvious as they are directly involved in the research on GM. Constructing GM as a solution by the researchers is coherent with their contextual background but it should not go up to the extent of making claims that GM can solve a major share of the agricultural problems in India. This strategic framing does not seem logical in the current scenario especially on the grounds of lack of proper infrastructure, policies and technical support in agriculture which was pointed out by the researchers themselves in their interviews. Bodh (2019) probes the probable factors contributing to the suicides of Indian farmers. He suggests that a managerial strategy which is multifaceted, is needed immediately to rescue the farmers from distress. Since proper infrastructure, suitable policies and technical support of a top notch standard are from among the list of requisites for GM crops and they are currently not properly in place. This study demonstrates that there are a lot of issues in agriculture which GM crops cannot solve. So, with the increased level of farmers' distress in India, there is a need to rethink the solution(s) on the basis of 'problematization' of agriculture.

6.3 GM debate in the media

The debate on GM crops has been prevailing in the media for a very long time. This is why a commentary on how the GM debate is presented in the media seems important. Out of the various actor groups, media is the one which provides a common platform for the direct contestation of 'problematizations' of GMOs by various actors. Keller (2011) explains the relation between social actors and discourse by saying that they are related in two ways; those who are the speakers and thus can (re)produce discourse and those who are targeted by discourse, the addressees. I bring this up to spell out and position media with respect to the GM discourse. Media's role, so far, shows that it is on the speakers side, re(producing) a large share of the GM discourse which affects the target audience.

From among a range of debates on various topics, the GM debate has been one of the most polarized ones. It is interesting to see how something can be interpreted so differently and reach such a polemic level. Media plays an instrumental role in the (mis)representation and (mis)interpretation of the arguments of GM debate. There are evidences of instances where a relatively simple confusion arising out of a piece of work or political decision which could have been clarified easily, had been blown out of proportion in the media. One such recent example is Swaminathan's controversy where a renowned personality in Indian agriculture biotechnology, Dr. M.S. Swaminathan was misinterpreted for his views published in a paper discussing Bt crops, which he co-authored, creating a media storm. It is to be acknowledged, however, that this is not exclusive in case of the GM debate but here it has a profound effect on the GM discourse. One possible reason for this could be the jargon language used by the actors in this debate limiting the target audiences' understanding about GM, and resulting in misrepresentations and when the media simplifies it, the original meaning gets distorted. Repeated use of inappropriate metaphors and phrases to discuss facts, as interpreted by media (for example, editors of newspaper or news channels), dreads the audience who is already ambiguous and sceptical about GM in the absence of other simplified communication explaining GM to them.

Cook (2005) decodes the representation of GM by different actors by doing a study in the UK with a focus on the language used. On the basis of 4 newspaper articles published in the year 2003, he concludes that the news of development in GM, published in the UK newspapers, are often speculative and lack actual facts. He gives examples of polemical articles published in the newspapers and argues that such polemical articles usually evoke strong approval or disapproval (from the target audience). The purpose of this citation is to understand the creation of polemics in the GM debate and to explain one of the findings of this study. This finding is about the misrepresentation of researchers as the ones giving undue weightage to GM crops based on their vested interest and putting them at one end of the polarized debate. This increases the polarization in the debate. In the discussion with the researchers it came out that majority of the researchers acknowledged that GM can be considered as one of the solutions from among a basket of choices based on the situation. This associates with what Kesavan (2018) mentions in his article about the reasons why GM should be considered as a supplementary solution and the need to carry out an unbiased and independent assessment of GM crops.

It is imperative to highlight the underlying reasons and the effects media produces in case of the GM debate. As mentioned earlier, creating pseudo polarization of actor groups and spreading fear using "flamboyant style and hyperbolic claims" (Cook, 2005, p. 56) are few of the major effects produced by media. Coming to reasons, it is easy to establish a link between popularity of a news with its level of

entertainment content. The purposeful misinterpretation of GM related statements to attract readers' attention (Cook, 2005) creating larger audience base can be one of the evident reasons which was pointed out by the researchers repeatedly citing variety of examples.

7 Conclusion

In this chapter I will reiterate the key conclusions that appeared in response to the three research questions of this study. Limitations of this study will also be discussed which came out as self-reflection about this journey of research. At last some suggestions to understand the GM debate in further similar studies, will also be shared.

7.1 Concluding the GM discourse and Indian agriculture

The alignment of 'problematization' of Indian agriculture between the researchers and farmers is explored in this study to understand the construction of GM crops as a solution for these problems. The focus of this study is to highlight how and why this 'problematization' is done in a particular way by the researchers and farmers. Whether or not GM crops need attention at this moment, depends upon this 'problematization'. Therefore, in order to understand the GM debate, it is imperative to understand Indian agriculture from the farmers' and researchers' perspective, as they are the two most important and directly involved actor groups in this debate out of a list of actors.

The use of WPR in this study sufficed its purpose by providing a suitable tool to keep the focus on the research questions. Discourse analysis while applying WPR in this research helped to understand the implicit assumptions that mark great impact on the GM debate. Discourses play an important role in the 'problematization' of agriculture. Different actors are the bearers of different discourses which shape their perceptions about agriculture and GM crops. A meticulous analysis of the 'problematization' of agriculture by different actors while taking into account their discourses, can help in detangling the threads of the GM debate. The analysis of researchers' and farmers' 'problematization' shows that they do not correspond neatly to each other. This dissonance can be explained by the difference in discourses and material circumstances of farmers and researchers. The point now is, since neither these 'problematizations' correspond well with each other not do they indicate that

GM can be the solution to farmers' problems, on what basis GM is constructed and offered as a solution to the problems of agriculture. One of the probable reasons could be communication gap between these two actors as this study shows that there is a communication gap between the farmers and the researchers. Although the researchers acknowledge the importance of communication but an emphasis on a two way communication is needed as it can play a key role in meticulously understanding the problems of agriculture.

Farmers in the current scenario are distressed by lots of issues but the problems where GM crops can be a solution, do not appear as the most worrisome ones. This 'problematization' also shows that there is a dire need of appropriate and clear policies, technical support, better infrastructure etc. to solve the problems of agriculture.

The GM debate, the one we identify occurring in the media, has many implications, including facts distortions, misguiding narrations and polarization of the debate. This study infers that the researchers are not as extremely polarized as they are presented in the media. In this era when media is so powerful, GM debate needs a more sensible handling by the media rather than fulfilling its own agenda for a big audience base by creating chaos. This study shows that the GM debate is not only about the credibility and use of GM crops rather it has a considerably significant level of involvement of business and politics in it, turning it into a debate about how our society should be organised and function. Shift in the perspective of actors involved in the debate "to see the problem differently" is sought with particular emphasis on increasing the participation of farmers in the 'problematization' of agriculture at all levels.

7.2 Limitations of this study

Farmers' and researchers' 'problematization' of agriculture was the focus of this study which needed an interaction with both the actor groups. During the course of this research I realised that the farmers are listing out the problems with a perspective as if they can be solved if paid proper attention whereas the researchers listed out the problems with a perspective as if its somebody else's (the government's) responsibility only, to solve those issues and there is nothing much in their hand to help the farmers with. The tone used by most of the researcher was fault finding and complaining towards either the policies of the government or the media which blurred the focus of the interview making it seem about "policy problems of agriculture" instead of "problems of agriculture".

Also, it would be interesting to see a comparison of interviews asking only the problems of Indian agriculture without asking question about GMOs, and interviews

of the kind done in this study where discussions on problems of agriculture and GM crops both is done, to explore strategic framing more authentically as this could only be discussed briefly in this study.

As the design of this study allowed and perhaps needed different methods for data collection, interviews with the researchers and PRA exercises with the farmers were done under this study. The amount of data generated as a result of interviews and PRA exercises were different and that led to difficulties later while doing the analysis and comparison of farmers' and researchers' data as there was a misbalance in the proportion of data from both the actors. Here the language barrier also played an important role which could have been minimized by better planning while choosing the study site and use of combination of data collection methods such as some interviews of key participants after the PRA exercises.

7.3 Way forward

For a better understanding of the GM debate in upcoming studies, the suggestions are:

- A pragmatic approach to design the research in a way that can closely examine the actors' engagement with the GM discourse.
- Inclusion of a variety of data collection methods and tools to be able to generate a more comprehensive data set.
- To explore the views of honest scientific brokers on the problems of agriculture to compare it with the GM researchers' views for a deeper understanding of the aspects of 'problematization'.
- Conduct more studies with different farmers' groups to understand the relation between the level of effect of material circumstances and discourses on their ways of 'problematizations'.

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Appendix 1

Researchers' interview questionnaire

Actor's questions

1) Whom do you see as the main actors with regard to GMO issue/ debate? (organisations, political parties, private companies, individuals)
2) maybe it has changed over time? (describe)
3) can you describe the role of these people/organisations with regard to GMO
4) What do you see as the main controversies with regard to GMO?

What's the problem represented to be

5) What are the big challenges today in India with regard to agriculture?
6) How does farming need to be changed to meet these challenges?
7) What of these challenges can be solved with more research and technology?
8) What of these challenges can we use genetic modification technologies to solve?
9) What types of GMO do we need to meet these challenges?
10) For what do we need other solutions?
11) Who needs genetic modification technology the most? (for what kinds of farming systems, what groups of people)
12) What is the biggest loss with not using GMO in farming?

Public resistance/ acceptance

13) You have described earlier to me why we need GM crops and for what…
14) which groups in society support your view
15) which groups do not support your view?
16) Do you have ideas about why they view it differently?
17) Is there something in the critique of GM crops that you think is relevant?
18) What? How?
19) What/ whom is it that stimulates resistance to GM crops today? / why are people sceptical?
20) Who is it that behaves incorrectly in the debate?
21) In what way do they behave incorrectly?
22) What do they do or say that is wrong?
23) In what way is it wrong? Morally, with regard to facts?
24) The farmers suicide had been in news and was debated intensely, can you share your views on this

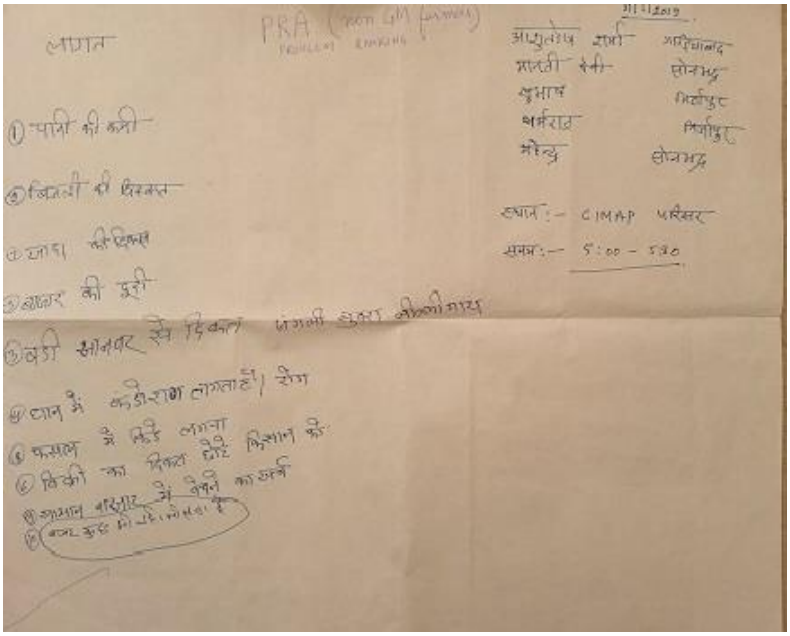
25) Vandana Shiva and Navdanya had been very critical to GM cropping, what do you think about it
26) M. S. Swaminathan also recently shared his views on GM crops, what do you think of that?
27) Do you have examples of when you think that facts have been distorted in the debate?
28) A quite common critique against GM crops is that the scientists are bought by the industry, what are your thoughts on this?

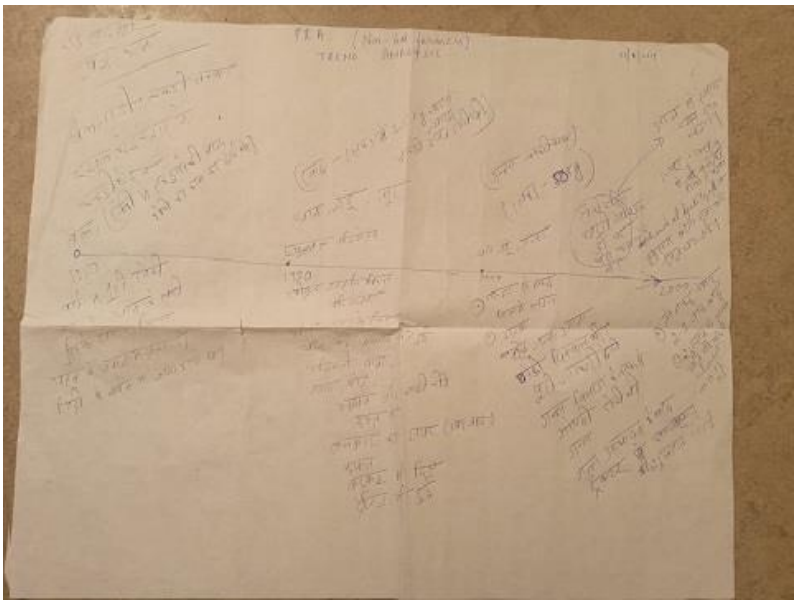
Personal identity

29) what is your research about?
30) Why did you want to do research on that? Whet drives you?
31) How is it to do research on GMO in a polarised climate?
32) How has this changed over time?
33) What is your research about?
34) Why is your research important?
35) What kind of effects does today's regulation have on research and development?
36) What kind of effects does today's regulation have on application?

Appendix 2

PRA Sheets of non-GM farmers





Appendix 3

PRA Sheets of GM farmers