Participatory Crop Improvement:
The challenges of and opportunities for institutionalisation in the Indian public research sector

Harley A. N. Pope

Doctor of Philosophy

University of Sussex

February 2013

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Signature: ……

Harley A. N. Pope

UNIVERSITY OF SUSSEX
Harley A. N. Pope, DPhil in Science and Technology Policy Studies

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Abstract

This thesis considers Participatory Crop Improvement (PCI) methodologies and examines the reasons behind their continued contestation and limited mainstreaming in conventional modes of crop improvement research within National Agricultural Research Systems (NARS). In particular, it traces the experiences of a long-established research network with over 20 years of experience in developing and implementing PCI methods across South Asia, and specifically considers its engagement with the Indian NARS and associated state-level agricultural research systems.

In order to address the issues surrounding PCI institutionalisation processes, a novel conceptual framework was derived from a synthesis of the literatures on Strategic Niche Management (SNM) and Learning-based Development Approaches (LBDA) to analyse the socio-technical processes and structures which constitute the PCI 'niche' and NARS 'regime'. In examining the niche and regime according to their socio-technical characteristics, the framework provides explanatory power for understanding the nature of their interactions and the opportunities and barriers that exist with respect to the translation of lessons and ideas between niche and regime organisations.

The research shows that in trying to institutionalise PCI methods and principles within NARS in the Indian context, PCI proponents have encountered a number of constraints related to the rigid and hierarchical structure of the regime organisations; the contractual mode of most conventional research, which inhibits collaboration with a wider group of stakeholders; and the time-limited nature of PCI projects themselves, which limits investment and hinders scaling up of the innovations. It also reveals that while the niche projects may be able to induce a 'weak' form of PCI institutionalisation within the Indian NARS by helping to alter their institutional culture to be more supportive of participatory plant breeding approaches and future collaboration with PCI researchers, a 'strong' form of PCI institutionalisation, in which NARS organisations adopt participatory methodologies to address all their crop improvement agenda, is likely to remain outside of the capacity of PCI development projects to deliver.

Acknowledgements

There are several people who I would like to thank for their help in making this thesis possible. My supervisors John Thompson and Erik Millstone have provided invaluable support and feedback throughout my doctorate. In the beginning their professional experience was very useful in exposing me to the academic literatures and debates that have gone on to feature prominently within this thesis. They have also given much of their own time to reading my drafts and helping me to improve their content. Without their tireless help and the academic culture of the STEPS Centre and SPRU, the whole process would not have been possible.

The majority of my fieldwork was carried out in India for over 11 months. This period of my life included exhilarating and memorable experiences that I will carry with me for the rest of my life. I would like to extend my gratitude to Rajesh Malik, Pritpal Randhawa, Rajesh 'Mangar' Raj and Vimlendu Jha, for being good friends and helping me adapt to Delhi life. Fieldwork took me to different states in India and I spent several months at the Centre for Research on Innovation and Science Policy (CRISP), in Hyderabad. CRISP acted as a temporary institutional home and I would like to thank Andy Hall, Rasheed Sulaiman, Kumuda Dorai and Murali for their help while I was there. I would also like to extend my thanks to Arun Joshi and Jagdish Prasad Yadavendra for aiding me in better understanding the Indian agricultural research system, GVT and negotiating access to several research organisations.

Finally, I dedicate this thesis to my wife Helen who has supported me during my final year, both emotionally and physically, and who helped get me to the finish line. Over the course of the thesis we became engaged in India and married in the UK, and she has put up with a lot! I would also like to thank my parents and family who have provided untiring love and support over the years, and without whom none of this would have been possible.

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List of Abbreviations

AAU	Anand Agricultural University
ACZ	Agro-Climatic Zone
ADG	Assistant Director General
AEO	Agricultural Extension Officer
AGM	Annual General Meeting
AICRP	All-India Coordinated Research Project
ASA	Action for Social Advancement
ATMA	Agricultural Technology Management Agency
CARIAD	Centre for Advanced Research in International Agricultural Development
CAZS-NR	Centre for Arid Zone Studies – Natural Resources
CBSP	Community-Based Seed Producer Group
CBO	Community-Based Organisation
CDR	Complex, Diverse and Risk prone
CGIAR	Consultative Group on International Agricultural Research
CIAT	International Centre for Tropical Agriculture
CIG	Common Interest Group
CIMMYT	International Maize and Wheat Improvement Centre
CO	Community Organiser
COB	Client-Oriented Breeding
CPA	Community Problem Analysis
CRISP	Centre for Research on Innovation and Science Policy
CRS	Catholic Relief Services
DAC	Department of Agriculture and Cooperation
DDG	Deputy Director General
DEO	District Extension Officer

DFID	Department for International Development
DMR	Directorate of Maize Research
DoA	Department of Agriculture
DPPB	Decentralised Participatory Plant Breeding
DRF	Dahod Research Farm
DRR	Directorate of Rice Research
DSR	Directorate of Soybean Research
DUS	Distinctness, Uniformity and Stability
EIRFP	Eastern India Rain-fed Farming Project
ESRC	Economic and Social Research Council
FAMPAR	Farmer Managed Participatory Research
FCI	Formal Crop Improvement
FLD	Front-Line Demonstration
FORWARD	Forum for Rural Welfare and Agricultural Reform for Development
FPC	Farmer Producer Company
FPR	Farmer Participatory Research
GAU	Gujarat Agricultural University
GMO	Genetically Modified Organism
GoI	Government of India
GR	Green Revolution
GVT	Gramin Vikas Trust
GxExM	Genotype x Environment x Management
HFCS	High Fructose Corn Syrup
IARI	Indian Agricultural Research Institute
ICAR	Indian Council of Agricultural Research
ICARDA	International Centre for Agricultural Research in the Dry Areas
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics

IDS	Institute for Development Studies (Sussex University)
IF-PRA	Issue Focused Participatory Rural Appraisal
IRD	Informal Research and Development
IRRI	International Rice Research Institute
IS	Innovation Systems
ITK	Indigenous Technical Knowledge
JNKVV	*Jawaharlal Nehru Krishi Vishwa Vidyalaya*
KRIBHCO	*Krishak Bharati* Cooperative Limited
KRIBP	KRIBHCO Indo-British Rain-fed Farming Project
KVK	*Krishi Vigyan Kendra* (Farm-Science Centre)
LBDA	Learning-Based Development Approaches
LI-BIRD	Local Initiatives for Biodiversity Research and Development
MANAGE	National Institute of Agricultural Extension Management
MLP	Multi-Level Perspective
MoA	Ministry of Agriculture
MOU	Memorandum of Understanding
MP	Madhya Pradesh
MPDPIP	Madhya Pradesh District Poverty Initiative Project
MPRLP	Madhya Pradesh Rural Livelihoods Project
MPUAT	Maharana Pratap University of Agriculture and Technology
NAEP	National Agricultural Extension Project
NARP	National Agricultural Research Project
NARS	National Agricultural Research System
NATP	National Agricultural Technology Programme
NBPGR	National Bureau of Plant Genetic Resources
NES	National Extension Service Programme
NREGA	National Rural Employment Guarantee Act

NRLM	National Rural Livelihood Mission
ODA	Overseas Development Administration
OFT	On-Farm Trial
OPV	Open-Pollinated Variety
PCI	Participatory Crop Improvement
PFT	Project Facilitation Team
PMU	Project Management Unit
PPA	Participatory Planning Approach
PPB	Participatory Plant Breeding
PPP	Public Private Partnership
PRA	Participatory Rural Appraisal
PRGA	CGIAR Systemwide Program on Participatory Research and Gender Analysis
PSC	Project Steering Committee
PSP	Plant Sciences Research Programme
PTD	Participatory Technology Development
PVS	Participatory Varietal Selection
QPM	Quality Protein Maize
R&D	Research & Development
R&E	Research & Extension
RAU	Rajasthan Agricultural University
RIU	Research into Use Programme
RLP	Rural Livelihood Project
RNRRS	Renewable Natural Resources Research Strategy
RVSKVV	*Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya*
SAU	State Agricultural University
SDAU	*Sardarkrushinagar Dantiwada* Agricultural University
SDEO	Subdivisional Extension Officer

SHG	Self-Help Group
SMS	Subject Matter Specialist
SNM	Strategic Niche Management
SPRU	Science Policy Research Unit
SREP	Strategic Research and Extension Plan
SRF	Senior Research Fellow
STEPS	Social, Technological and Environmental Pathways to Sustainability Centre
T&V	Training & Visit
TAR	Technology Assessment and Refinement
TL	Truthfully Labelled
ToT	Transfer of Technology
TPE	Target Production Environment
VCU	Value for Cultivation and Use
VEW	Village Extension Worker
WIRFP	Western India Rain-fed Farming Project
ZARS	Zonal Agricultural Research Station
ZREAC	Zonal Research and Extension Advisory Committee

1 Introduction

A central topic of this thesis is Participatory Crop Improvement (PCI), that is to say, the participation of farmers with scientists in the process of agricultural research and development in the context of developing countries. Crop improvement often consists of the process of plant breeding and the evaluation of resulting plant varieties. PCI is a set of research methodologies that are based on the assumption that involving farmers in the creation of new plant varieties through a process of collaborative research will help produce varieties better suited to the needs of the farmers, their socio-economic conditions and the agro-ecologies of their fields. The argument for PCI suggests that by better considering farmers' criteria of varietal choice, plant breeders can create varieties that are more appropriate and desirable to farmers, and therefore farmers are more likely to adopt and retain those research products.

When considering my choice of a research topic I found the argument for PCI to be particularly persuasive and wanted to investigate it further. As an undergraduate I studied Biochemistry and Molecular Biology and developed an interest in genetics and the mechanisms of gene expression, working on a couple of small research projects in that field. After finishing those projects I realised that I was more interested in the philosophy of science and technology, and their support and application through policy, rather than working in a laboratory. During my undergraduate degree I also developed a passion for environmental ethics and green politics, and rather than specialise further in biochemistry, I chose to retrain by doing an Environmental Science and Ecological Management Masters. Over the course of the Masters I found that my previous natural science background was useful for understanding the more technical aspects of environmental science, in particular issues surrounding Genetically Modified Organisms (GMOs). I was also particularly drawn to issues concerning biodiversity and ecological management, agricultural science and the environmental problems associated with farming and the expansion of agricultural frontiers into surrounding non-agricultural habitats. At that time I came to the realisation that people tended to value their surroundings in an anthropocentric way and that any arguments towards a deep ecology, where life has inherent value, would likely be trumped by the more immediate livelihood needs and differing desires of the people occupying a space. This led me to consider the factors which govern the construction and implementation of effective policies aimed at supporting scientific

endeavours and environmental protection. In both these cases new policies entail the formulation and assertion of a set of values and processes by one group of people onto other groups of people, some of whom may have vested interests in the *status quo* and therefore resist change. I was also interested by development and agriculture in less-economically developed countries, and the effects that international policy initiatives had on their local agriculture contexts.

After my Masters I decided to investigate these issues in further depth and applied for a DPhil at the STEPS Centre. It was here while constructing my research proposal that I was sensitised to the concept of farmer participatory research, in particular its application within the field of crop improvement. I found PCI to be an interesting research topic since I could draw on my background in genetics to understand some of the more technical aspects of plant breeding, while it also addressed my interest in the mechanisms of policy formulation and implementation. PCI presented an alternative set of stories that criticised the limitations of the ways in which conventional agricultural research are organised and its failures to develop appropriate and desirable varieties for certain types of farmers, in particular those faced with complex, diverse and risk prone (CDR) farming environments, such as rain-fed farming in arid zones. I found that this contrarian critique of the dominant international agricultural research paradigm resonated with my interest in how policy was constructed, implemented and contested by different stakeholders.

PCI has been in existence in one form or another for close to 20 years, yet it remains marginalised within agricultural research systems; it has not become the new plant breeding *modus operandi* in national and international research systems, even when supposedly directed towards the needs of farmers in CDR farming environments. An investigation into all the potential reasons for those shortcomings would be beyond the scope of any single thesis. PCI can be thought of as a diverse set of methodologies that may be applied in varying degrees and under various institutional contexts. In trying to generalise about PCI there is both a classification difficulty that is further compounded by the context dependence of the project in which it is carried out. In response to those difficulties, I decided to focus on one of two groups of PCI practitioners who have been experimenting and developing PCI for close to 20 years. The example of PCI I selected was largely funded by the UK Department for International Development (DFID), and was extensively carried out in South Asia.

A significant number of these PCI DFID-funded projects were carried out in India, a country that has a heterogeneous farming scene that, if the claims of PCI advocates are to be believed, would be expected to benefit from the application of PCI methods. In 2001 there were over 234.1 million agricultural cultivators and labourers working in India, (DAC statistics, 2001). Although Indian agriculture is dominated by small-holders who operate on less than 2 Ha of often marginal land and contribute to just over half of Indian agricultural output (Gulati, 2009b). India's growing rural population has resulted in increased fragmentation of land holdings which continue to shrink every year to an average size of 1.16 ha 2010-11 (GOI, 2012). Approximately 68% of India's current net cultivated land is rain-fed, which in turn supports over 360 million people, though this may rise to 600 million by 2020 (Farrington et al., 1998). Although crop breeding progress has been made for irrigated and higher potential production environments, uptake of modern varieties by farmers in marginal and rain-fed areas has been far less (*Ibid.*). The gross irrigated area as a per cent of gross cropped area has increased from 34% in 1990-91 to 45.3% in 2008-09, however these figures vary greatly depending on the State (DAC, 2012). India has the second largest public agricultural research system in the world, yet in spite of this the public and private sector account for only approximately 15 to 20 percent of all the seed distributed across the country (DAC, 2012). The majority of seed is distributed via farmer-to-farmer seed dissemination networks or is saved from the previous year (*Ibid*.). Collectively this data suggests a scenario in which conventional public-sector agricultural research and extension is not delivering equitable benefits to all of India's different types of farmers.

There is evidence to suggest that PCI approaches can be beneficial to smallholder farmers in CDR farming environments, such as those faced by many Indian farmers (Witcombe et al., 1996, Joshi and Witcombe, 1996, Weltzien et al., 2003). The question underlying the research for this thesis has been, "Why has PCI not been widely adopted and integrated within the Indian national agricultural research system (NARS)?" In this thesis I have looked at the structure of a key project operating in India and its interactions with the Indian NARS to try and provide answers to this question. The answers may also provide some generalisable information of use to agricultural researchers, and especially to practitioners carrying out PCI in other development projects, engaging with other NARS, and to policy makers with respect to ensuring that their research is suitably and sufficiently client-oriented.

In the *literature review* I will outline the history and development of farmer participatory research and PCI from its origins to the current day; including a more in-depth account of the

rationale which underpins the principle of 'farmer participation' and the critiques which contest its efficacy. I then develop a novel *conceptual framework*, consisting of a synthesis of concepts from Strategic Niche Management (SNM) and Learning-Based Development Approaches (LBDA) literatures, which I use to characterise the Indian NARS, the case study projects, and the relationships between them. This characterisation of the constituent elements of NARS and PCI projects will help explain the barriers and opportunities for the institutionalisation of PCI in the context of India and more generally in other PCI projects.

The first empirical chapter characterises *Indian public plant breeding as a socio-technical regime* by considering the evolution of the Indian NARS from its origins to the present day through the conceptual lenses of the framework (Chapter 4). The Indian NARS has a central, federal component which interacts and exerts significant influence over the state agricultural research systems. The relationship between the two components is one in which the state systems are largely beholden to the central system on account of the funding and research coordination that the centre provides. This characterisation of the Indian NARS forms the basis for comparing the structure and function of the NARS and its plant breeding activities with those of the PCI development projects in the following two chapters.

The second empirical chapter provides an evolutionary account of the PCI development projects and the way in which they engaged with the NARS (Chapter 5). The chapter exposes the dynamics of the organisations which made up the PCI project and their rationale for working with the NARS and the difficulties which this entailed. The third empirical chapter considers the legacy of the case study projects and the limitations of working with State Agricultural Universities (SAUs) in a contractual manner with respect to institutionalising and sustaining the benefits of the project (Chapter 6). This chapter also considers the use of PCI by NGO project partners in other development projects and highlights the importance of the public NARS in sustaining the new crop varieties produced.

The final chapter addresses the concept of the institutionalisation of PCI methods within the Indian NARS and discusses whether it is an achievable goal (Chapter 7). It considers the socio-technical characterisation of PCI projects and NARS introduced in the earlier chapters and identifies opportunities and constraints for institutionalisation that may be applicable more generally to other PCI development projects and NARS in other contexts.

2 Literature Review

2.1 Introduction

This chapter takes the form of a literature review which outlines the development and evolution of Participatory Crop Improvement (PCI) and its link to the 'Farmer First' and Farmer Participatory Research (FPR) schools of thought. To begin with I talk about FPR, in particular its origins as a critique of mainstream research methods and some of the core assumptions underlying them. I go on to describe how FPR developed, drawing on the *Farmer First* conferences and the papers published from them as a litmus test for identifying the prominence of different issues within this field of research. Next I consider the development of PCI as a set of research methodologies linked to FPR. I present a chronology of key PCI developments in terms of both the theory as well as some of the major research groups who have experimented and applied it to their work. I then examine some of the key critiques, ideas and hypotheses which are often cited by PCI advocates to justify the need for greater use of PCI in research systems. Following this I apply a typology of PCI to consider its characterisation by a number of major research groups who have engaged with and developed PCI methodologies. This characterisation of PCI will demonstrate that there are strong similarities between how different groups define PCI, but that PCI represents a select number of methodologies and principles that can be applied selectively and to various degrees depending on the situation. Finally I reflect on the current stalling and limited mainstreaming of PCI in global agricultural research organisations and present some general counter-narratives to PCI that have been discussed in the literature. The limited mainstreaming of PCI methods despite its potential to address certain criticisms levelled at agricultural research systems serves as a basis for justifying the need for this and further research into what opportunities and hindrances there are to its uptake, use, mainstreaming and potential for institutionalisation within crop science research organisations.

2.2 The Rise of Farmer Participatory Research (FPR)

It is important to outline first the development of the theoretical and conceptual ground from which it has arisen. Participatory Crop Improvement (PCI) is a part of the larger field of Farmer Participatory Research (FPR). FPR is a mode of research in which farmers and scientists work together in order to co-create and produce new innovations and technologies. PCI is this

mode of research applied to the domain of crop improvement, i.e. the process of breeding new plant varieties (research), and their marketing, dissemination and uptake by farmers (extension). Both PCI and FPR are based upon a shared critical analysis of normative agricultural research and extension systems, highlighting a failure of these systems to meet the needs of certain types of farmer and farming systems. FPR sees greater farmer participation as the means by which some of these failures may be addressed. This principle of 'participation' is a core characteristic of FPR and PCI research, although it may be implemented in different ways and to varying degrees depending on the context.

Many of the experiences of natural and social scientists experimenting with FPR have been encapsulated within three books, each corresponding to different Farmer First conferences held at the Institute for Development Studies (IDS), University of Sussex (Chambers et al., 1989, Scoones and Thompson, 1994a, Scoones and Thompson, 2009). Each conference represents a snapshot of the issues being investigated by a global community of FPR practitioners at a particular time, and when viewed together, provides insight into the development of FPR to the present day.

2.2.1 Farmer First (1987)

The first *Farmer First* conference took place in July 1987 over five days under the name 'Farmers and Agricultural Research: Complimentary Methods', and consisted of approximately 50 researchers split equally between the natural and social sciences (Chambers et al., 1989). A *Farmer First* book was subsequently published in 1989 that recounted some of the experiences of the conference and published many of the presented papers (*Ibid*.). Rather than simply an edited book featuring a selection of presented papers, the concept of *Farmer First*, and its associated participatory modes of research, became a popular thesis which challenged conventional agricultural research and extension orthodoxies.

Many of those attending the conference had been developing similar types of participatory research methods in different parts of the world, often in parallel to each other, and sometimes in isolation. At the time, many of these researchers were pioneers within their respective research institutions, often finding themselves and their research foci marginalised or in the minority compared to the general thrust of mainstream agricultural research (*Ibid.*). The term 'complimentary methods' was used in the conference title to stress that the new

approach was not an alternative or complete substitute to conventional agricultural research, in which the locus of activities were centred in the lab and on research station land. The conference participants generally acknowledged that many benefits had been generated from the efforts of conventional commodity-oriented and farming systems research. Rather it emphasised the importance of directing and re-orienting research priorities to better consider farmers' needs and the benefits of stimulating and supporting their capacity to innovate, design technology and problem solve. Over the course of the conference, many of the researchers' experiences were found to better meet farmers' priorities, and, as Chambers describes in his foreword, "We found we were dealing with a new paradigm, in the sense of mutually supporting concepts, values, methods and action. To this the term 'farmer first' has been applied, distinguishing it from the conventional paradigm of 'transfer of technology'. (Chambers, 1989:xiii)"

Central to the *Farmer First* paradigm is the idea that certain types of farmers and farming system are not well served by conventional agricultural research. In the *Farmer First* book, they consider three broad types of agricultures: Industrial, Green Revolution (GR) and a third kind which is characterised as complex, diverse and risk-prone (CDR) – as outlined in the Brundtland Commission (WCED, 1987: 120-2). Other than being complex, diverse and risk-prone, CDR agricultural systems are often located in tropical, rain-fed and hinterland environs. Moreover, a CDR farming system usually consists of small-scale agriculture carried out by resource-poor farmers, of both sexes, who typically use only low quantities of purchased inputs (fertiliser, pesticide and seed). Globally CDR agriculture supports approximately 1.9-2.2 billion, with Industrial and GR agricultures supporting approximately 1.2 billion and 2.3-2.6 billion respectively (Pretty, 1995:2). Furthermore, CDR agriculture likely supports a majority of the world's poorest and most vulnerable people (Chambers, 2007). It is this type of agriculture and farmer that are not well served by mainstream agricultural research institutions.

Some suggested reasons for the success that mainstream research has had with respect to industrial and GR agricultures include:

> "... conditions on research stations, with controlled environments and easy access to inputs, have usually been close to those of resource-rich farmers: what does well on the research station can therefore do well, other things being equal, with the farmer. Another is that the standard methods of agronomic research have generated high input packages which are simple and amenable to widespread adoption in uniform and relatively low risk environments. Yet another factor is that the sorts of farms and farm families

> best able to benefit - those which are resource-rich, with good farming conditions and good access to capital, inputs and markets – have been well represented in the main industrial and green revolution agricultural areas; and in green revolution areas, many smaller and poorer farm families have also managed to make some gains from the new technologies." (Chambers et al., 1989: xviii)

However, contrasting with industrial and GR agricultures, CDR farmers do not have the "physical, social and economic conditions" compatible with the research station environments and the technologies which are produced (*Ibid.*). These farmers have failed or been slow to adopt the new agricultural technologies and methodologies. Ever since the GR, analysts have tried to explain why the benefits of the new GR technologies have not been fully realised by some farmers and totally bypassed others.

> "In the 1950s and 60s, non-adoption was often attributed to ignorance, and extension education was prescribed. In the 1970s and the earlier 1980s, non-adoption was more often attributed to farm-level constraints; gaps in yield between research station and farm were analysed; and the prescription was to make the farm more like the research station. In the 1980s, however, a new interpretation, more challenging to agricultural professions and to science, has gathered support. It is that the problem is neither the farmer nor the farm, but the technology; and that the faults of the technology can be traced to priorities and the processes that generate it." (Chambers et al., 1989: xix)

Reasons for this nascent attribution of blame for the selective failures of the GR due to inappropriate technology stemmed from a number of insights, including:

- A greater recognition, understanding and validation of aspects of indigenous technical knowledge (ITK) and practices (Richards, 1985).
- An improved understanding of the lack of constructive linkages and bi-directional communication between scientists involved in research and extension activities, and farmers (Gupta, 1989, Raman, 1989, Chambers, 1989).
- Increased direct consultations between scientists and farmers on the reasons behind their non-adoption of GR technologies (Rhoades, 1989, Maurya, 1989).
- Understanding that farmers not only have the potential to experiment and innovate, but often do so integrally within their farming practices as a matter-of-course (Johnson, 1972, Rhoades and Bebbington, 1988, Maurya, 1989, Bunch, 1989, Rhoades, 1989).

In the minds of FPR proponents, agricultural technologies and methods can be made more appropriate by considering the farmer first, i.e. engaging with and involving them in the research and development process and also, where appropriate, stimulating and facilitating their own capacities to innovate and experiment. There can be misunderstandings and miscommunication between research scientists and CDR-type farmers on account of their often differing ontological and epistemological world views (Gupta, 1989). To remedy this, scientists and farmers can engage with each other through participatory modes of inquiry such as the Participatory Research Appraisal (PRA). Farmers and scientists may also carry out participatory technology development (PTD). Recorded in the *Farmer First* book are several chapters that document some form of PCI; mainly focusing on on-farm research, and the pre-screening and evaluation of plant genetic material, *inter alia* (Sumberg and Okali, 1989, Ashby et al., 1989).

In the final chapter of the book, Chambers summaries the new paradigm as one that promotes and facilitates farmers' own *analysis* and framings of their agricultural problems; provides them with a real *choice* of information, methods and technologies appropriate to their analyses; and, by supporting and providing consultation services for their *experimenting* activities (Chambers, 1989). In this chapter he sets the *Farmer First* approach as contrary to the normative form of research extension activities typified by a 'transfer of technology' (ToT) mode, in which scientists dictate the research priorities, carry out the research, pass the finished product onto extension agents, who then transfer it to farmers as a finished package of practices[1] - See Table 1 (*Ibid.*).

[1] 'Package of practices' refers to an agricultural technology, such as a seed variety, and the associated agronomic practices which should result in its optimal performance, i.e. fertiliser/pesticide doses and schedule, plant spacing etc.

Table 1 - Transfer-of-Technology and Farmer-First Compared

	Transfer of Technology (ToT)	**Farmer First**
Main objective	Transfer technology	Empower farmers
Analysis of needs and priorities by	Outsiders	Farmers assisted by outsiders
Primary R&D location	Experiment station, laboratory, greenhouse	Farmers' fields and conditions
Transferred by outsiders to farmers	Precepts Messages Package of practices	Principles Methods Basket of choices
The 'menu'	Fixed	A la carte

Source: Chambers (1989: 182)

Chambers (1989) acknowledged that packages of practices and ToT approaches are firmly embedded and well-established within agricultural research bureaucracies. Furthermore these bureaucracies tend to standardise, simplify and centralise practices – behaviour that is at odds with the needs of addressing complex, diverse and risk-prone agriculture (*Ibid.*). Rather than trying to homogenise farming environments through extraneous measures to fit the genotype/technology, the 'third' agriculture requires diverse genotypes and technologies to fit its heterogeneous farming environments. In order to generate *Farmer First*, reversals of normalised research practices Chambers (1989) states that there needs to be institutional change. He puts forward some suggestions as to how this might be brought about, including (*Ibid.)*:

- Decentralisation of power over finances, resources, and research objectives.
- Increased emphasis on the search for and supply of new innovations, farmer-innovators, germplasm, technologies, etc., from local to global in scale.
- Putting into place an incentive structure and enabling conditions that reward the *Farmer First* mode.
- Further development, refinement and dissemination of *Farmer First* methodologies.

The importance of the first *Farmer First* conference is that it established a strong alternative model and critique to the conventional agricultural research paradigm. Having arisen out of FPR, PCI uses much of the *Farmer First* critique to justify its approach to agricultural research. FPR has also been heavily funded by development agencies because part of its rationale is to target CDR agriculture and resource poor farmers. As such, PCI not only consists of reforming

principles for conventional agricultural research systems, but represents a way for potentially targeting resource poor farmers with new and appropriate agricultural technologies. It is in this latter capacity that PCI has been used within development projects, and to some extent has become inextricably tied to a wider debate on 'participatory development' (*Cf.* Chambers (2008b)).

2.2.2 Beyond Farmer First (1992)

The second Famer First conference occurred in October, 1992, five years after the initial conference. In 1994 the '*Beyond Farmer First*' book was released with the purpose of revealing "how agricultural research and extension, far from being discrete, rational acts, are in fact part of a process of coming to terms with conflicting interests and viewpoints, a process in which choices are made, alliances formed, exclusions effected and worldviews imposed (Scoones and Thompson, 1994a: back cover)."

In the intervening time between the conferences FPR methods had been experimented with and implemented by an increasing number of research and development professionals, yet still remained marginalised within agricultural research organisations who continued to promote conventional ToT approaches to research and extension (Scoones and Thompson, 1994a). With the rising popularity of participatory thought and methods, Chambers also argued that the participatory rhetoric had been co-opted by some organisations and research groups in a tokenistic manner with little practical substance (Scoones and Thompson, 1994a: xiii). He argued that, in order to address this, practitioners and academics needed to provide a more rigorous definition of FPR and explicate its theoretical assumptions more fully.

The second conference expanded the original *Farmer First* thesis, which was criticised for being naively populist in its outlook in that it failed to unpack the complex relationships, sub-groups and interests that make up different terms such as 'farmer' or 'community' (Gubbels, 1994, Scoones and Thompson, 1994b). In Table 2 Scoones and Thompson (1994b) summarise the differences between knowledge systems, processes, power and relationships as they are conceived in *Farmer First* and *Beyond Farmer First*.

Table 2 - Beyond Farmer First: Challenging the Populist View

	Populist Approaches: *Farmer First*	***Beyond Farmer First?***
Assumptions	Populist ideal of common goals, interests and power among 'farmers' and 'communities' 'Stock' of uniform, systematized, local knowledge available for assimilation and incorporation.	Differentiated interests and goals, power, access to resources between 'actors' and 'networks'. Multi-layered, fragmentary, diffuse knowledges with complex, inequitable, discontinuous interactions between (local and external) actors and networks.
Process	'Farmer' or 'community' consensus solutions to identified problems. Managed intervention, designed solutions and planned outcomes with farmer involvement in planning and implementation	Bridging, accommodation, negotiation and conflict meditation between different interest groups. Process learning and planning with dynamic and adaptive implementation of negotiated outcomes; collaborative work requiring dialogue, negotiation, empowerment.
Role of 'outsider'	Invisible information collector, documenter of RPK[2]; planner of interventions, manager of implementation, more recently: facilitator, initiator, catalyst.	Facilitator, initiator, catalyst, provider of occasions; visible actor in process learning and action.
Role of 'insider'	Reactive respondent; passive participant.	Creative investigator and analyst; *active* participant
Styles of investigation	Positivist, hard-systems research (FSR, AEA, RRA some PRA, FPR & PTD[3])	Post-positivist, soft-systems learning and action research (PAR; increasingly FPR, PRA & PTD)

Source: (Scoones and Thompson, 1994b:22)

Despite the increasing popularity of the *Farmer First* thesis and participatory methods, Chambers admitted that, "The changes advocated in the Farmer First book are still nowhere near being realized on the scale or with the commitment needed (Scoones and Thompson, 1994a: xiii)." As well as refining the theory of FPR and presenting innovations in FPR methods, the participants at the conference began to consider the constraints of institutionalising FPR

[2] Rural People's Knowledge
[3] FSR = Farming Systems Research; AEA = Agro-ecosystems Analysis; RRA = Rapid Rural Appraisal.

methodologies within agricultural research organisations (Pretty and Chambers, 1994). The discussions on FPR 'institutionalisation' were visionary in their intent, but provided no real pathways to dismantle the old-order, overcome strongly embedded institutional constraints, and implement or achieve their lofty goals.

2.3 The Development of Participatory Crop Improvement (PCI)

While many of the themes and issues addressed in the Farmer First conferences are representative of wider issues discussed in farmer participatory literatures, Farmer First does not constitute the totality of research carried out on FPR. PCI methodologies have been developed in parallel to the Farmer First literature; have directly contributed to it; and have also gained insight from the experiences of other research and development groups using participatory methods in contexts other than crop improvement. In this section I will outline what is meant by the term PCI and provide a brief history of its development, before unpacking it further and providing a more detailed characterisation of it in the following section.

At the start of PCI's rise as a research methodology there were a number of different researchers and groups around the world carrying out and developing similar methods but describing them using different terminology. The Farmer First movement and farmer participatory research (FPR) have already been mentioned above, but other terms that have been used to refer to similar crop improvement initiatives include: Collaborative Plant Breeding (Soleri et al., 2000), Farmer Participatory Breeding (Courtois et al., 2001), Participatory Plant Breeding (PPB) (Sperling et al., 2001), Client-Oriented Breeding (COB) (Witcombe et al., 2005), and Participatory Crop Improvement (PCI) (Witcombe et al., 1996). Throughout this thesis I use the latter term, PCI, as a *mot juste* for these terms, since it is an 'umbrella' term that encompasses participatory modes of research as applied to the methodologies that make up the entire crop improvement pathway. As such, PCI is a form of FPR and Participatory Technology Development (PTD) related to crop improvement; some of its supporters have contributed to the evolution of the Farmer First thesis; and it consists of a basket of core principles and methodologies that can be applied, to varying degrees, throughout the crop improvement process.

The conventional, ToT, agricultural scientist-led form of crop improvement can be thought of as a pathway by which novel improved genetic material is generated though plant breeding; is evaluated and tested in trials; is multiplied in quantity; and then disseminated directly and indirectly (via markets and/or government schemes) to farmers. This latter dissemination process is often called 'extension'. PCI can be subdivided into two main groups of crop improvement methodologies: Participatory Plant Breeding (PPB) and Participatory Varietal Selection (PVS) (Witcombe et al., 1996). In essence PVS is the evaluation of advanced plant lines or finished varieties by farmers under their own management conditions (Walker, 2008). While PVS is chiefly concerned with involving farmers in evaluations, PPB seeks to involve farmers earlier in the breeding process in order to elicit relevant information on their farming systems and desired crop traits, and later on to select promising varieties and evaluate them (*Ibid*.). PVS may be used at the start of a PPB project by selecting amongst available varieties in order to ascertain the current performance and suitability of crop landraces and currently available varieties, as well as the crop traits which farmers deem a priority; or, PVS can be employed later on in the breeding programme to evaluate the advanced plant lines or finished varieties and potentially increase varietal adoption.

PPB cannot be easily stereotyped because there are numerous methods of carrying it out which vary according to the farmer, crop type, mating system, breeder, and breeding program within which it is situated (Ceccarelli et al., 2000). It is therefore difficult uniquely to define research efficiencies; determine whether empowerment of participants has occurred; and generalise research findings to incorporate all types of PPB.

2.3.1 A Characterisation of PCI

'Participation' is a polysemic word that can be used by different people in different ways to mean different things. In the context of crop improvement several attempts have been made to characterise just what participation is and the different ways it can be applied to the crop improvement process (PCI). For this characterisation of PCI I have chosen a reductionist framework for analysing PPB projects published by Louise Sperling and her colleagues that arose from their analysis of the PPB project inventory of the Participatory Research and Gender Analysis (PRGA) Programme (Sperling et al., 2001).

The PRGA framework identifies a comprehensive range of variables that allow for a characterisation and discrimination of different PCI approaches. These variables include: institutional context, the bio-social environment, project goals, stakeholder roles, and the degree of participation achieved. Many of these factors will vary between PCI projects and programmes, but when considered together can aid in classifying the form of PCI according to its method and the organisational-context it is used in. A typology can also differentiate between the type of PCI and its costs and benefits as carried out under differing institutional contexts, and can help to "judge its utility for a given objective (Sperling et al., 2001: 440)".

Within this characterisation of PCI I will address the variables outlined in the PRGA framework with examples taken from the two main PCI research groups: Highly Client-Oriented Plant Breeding, also known as (COB), as carried out by CAZS-NR and its research partners, and Decentralised Participatory Plant Breeding (DPPB) as carried out by ICARDA in its barley breeding programme (Witcombe et al., 2005, Witcombe et al., 2006, Ceccarelli and Grando, 2007). I will also refer to a concept called 'efficient participatory breeding' that was put forward in a publication by Morris and Bellon (2004). 'Efficient participatory breeding' suggests that there may be an optimal form of PCI which takes into account the strengths and weaknesses of different crop improvement institutional forms.

2.3.1.1 Stages of Crop Improvement

Crop improvement stages represent different activities in the crop improvement process and potential opportunities for farmer involvement. It is important to establish an inclusive synthesis of the stages of crop improvement that different methodological treatments of PCI list in order to resolve any differences between them. The majority of the PCI methods use as their basis the plant breeding stages as described by Schnell (1982). I have created an amalgamation of the different stages of crop improvement used in the PRGA Framework, efficient plant breeding, COB and DPPB publications – See Table 3.

Table 3 - Amalgamation of Different PPB Stages

	Redefined PPB Stages
1	Goal setting
2	Breeding targets
3	Generating diversity
3a	*Selection of source germplasm*
3b	*Making initial crosses*
4	Selecting in segregating generations
5	Cultivar development
6	Testing varieties
7	Variety release and seed production
8	Outcome assessment

Source: *Adapted from (Schnell, 1982, Sperling et al., 2001, Morris and Bellon, 2004, Witcombe et al., 2005, Ceccarelli and Grando, 2007)*

'Goal setting' and 'breeding targets' are similar but subtly different aspects of the project planning stage with the former concerning meta-goals and desirable outcomes, stakeholder roles, etc.; and the latter representing a translation of these goals into plant breeding targets. The generating diversity stage refers to the selection of crop cultivars/land races to breed with, and making the initial crosses. 'Selection in segregating generations' is geneticist parlance for selecting particular traits in the second generation (F2) after the initial parental cross. It is in the F2 generation that alleles are independently assorted and this population represents maximal genetic diversity (*Cf.* Mendel's Second Law – Independent Assortment of Alleles). The F2 generation represents maximum genetic diversity within a plant population from which farmers and breeders can select those plants that perform best with regard to their respective selection criteria. Cultivar development, as mentioned here, refers to the process that comes after selecting promising plants. Essentially it consists of methods of in-breeding that are used over a number of generations in order to increase the genetic purity (uniformity, heritability and stability) of the candidate crop cultivar into an 'advanced line'. When a promising candidate variety has been established it is then tested to see whether it outperforms other candidate varieties and has useful and desirable qualities. Once it has successfully negotiated the varietal testing pathway it may be recommended and notified for release. At this point the quantity of seed can be multiplied and scaled-up so that it can be sold or disseminated to farmers as appropriate.

The plant breeding process can be represented in both a linear and cyclical fashion. The linear representation best describes the form of plant breeding that occurs within a time-limited project in which a small number of crosses are carried out at the beginning, with a view to producing advanced lines or finished varieties at the end. In any given season, plant breeders in conventional plant breeding programmes will be engaged in all of the above stages of crop improvement, managing plant populations at different stages in their development. This difference is significant and one which is not obvious from a reductionist typology. In their article on DPPB, Ceccarelli and colleagues state that until PPB is carried out in a cyclical manner it cannot be considered plant breeding *per* se, but remains in an experimental format until farmer participation becomes an essential and fixed part of the breeding process (2001:534).

Other than the act of breeding itself, PPB projects can be thought of as consisting of *ex-ante* and *ex-post* elements in relation to the physical act of plant breeding:

- Ex-ante:
    - Project planning
        - Goal setting
        - Breeding targets (trait inclusion)
    - Ex-ante appraisal (e.g. PRA)
- Ex-post:
    - Interacting with seed systems
        - Variety release
        - Popularisation/marketing/diffusion
        - Seed production
        - Extension (marketing and distribution)
    - Ex-post outcome assessment

Together they represent stages that may exist within the continuum of plant breeding processes or may be seen as supplemental to it.

The stages of crop improvement listed above largely refer to the process of plant breeding. What then is PVS and how does it relate to the stages of PCI? In essence PVS consists of the evaluation of finished cultivars or advanced lines by farmers under their own management conditions, often on their or some communal land. Through their direct involvement in evaluation, PVS allows farmers to more accurately gauge the performance of the cultivars and choose those which are appropriate for them. PVS is often carried out in the form of 'mother'

and 'baby' trials. Mother trials are centralised and feature *all* of the varieties to be tested. They are often maintained by a non-farmer, i.e. NGO or agricultural scientist, but under typical farmer management conditions for the area. Baby trials are carried out by different farmers on their land and typically consist of a direct comparison between the test variety and a local check variety. From observing farmer evaluation plant breeders gain a first-hand understanding of farmer preferred cultivars and traits, management techniques and environmental conditions affecting the crops. This information can be used by plant breeders to evaluate finished crop varieties or set new breeding targets and goals. PVS can be used as an activity at the beginning of a plant breeding project to accurately determine project goals and breeding targets (Witcombe et al., 1996, Witcombe et al., 2005). Later on in a PPB project it is the main evaluative process by which promising plant lines are tested. In this regard it can be considered both a research tool, in that it provides information upstream and downstream of the breeding process; and an extension method, by allowing farmers to test varieties for themselves. The act of being directly exposed to new crop varieties is thought to sensitise farmers to their potential and increase adoption of popular varieties (Witcombe et al., 1996).

2.3.1.2 Degrees and Location of Participation

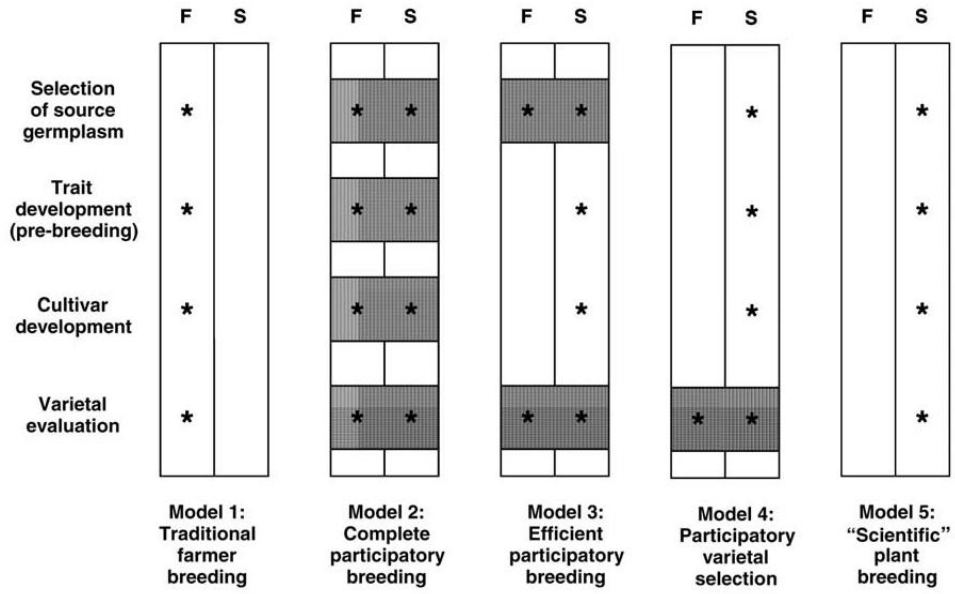
The PRGA framework lists several different degrees of participation that range from: manipulative; through, passive, contractual, consultative, collaborative, collegial; to, farmer- or community-initiated (Biggs, 1989, Lilja et al., 2000). As illustrated by the different qualities of participation, what one person calls participatory may be far removed from what another means by it. Moreover, the word can be used in a tokenistic manner by those who wish to disguise the manner in which they engage with their stakeholders (farmers/clients), or by those seeking to label their current research activities 'participatory' in order to avail themselves of funding opportunities linked to participatory research. In practice though, the PRGA framework argues that the majority of participation in PPB falls between consultative, collaborative and collegial forms (Sperling et al., 2001).

At any given stage of the crop improvement process there is an opportunity for scientists and farmers to work together to co-create new crop varieties, but this can vary between projects depending on their goals, inclinations, and the resources available to them. Variations in the degree of participation and the locus of crop improvement activities significantly condition the form of PCI that results. Morris and Bellon's (2004) model hypothesises an 'efficient' form of

plant breeding that employs the relative strengths of the formal/global crop improvement system and more local national and regional systems. The model defines different forms of PPB according to whether farmer and scientist interaction is present or needed at each stage of the plant breeding process.

This is an important issue as one criticism of participatory methodologies is that under certain circumstances they can be more resource intensive than established non-participatory programmes. Research efficiency is particularly important in the context of CGIAR and NARS centres which often have ambitious mandates but limited budgets. The clear-cut dichotomous approach of 'presence' or 'absence' of an interaction lacks the more nuanced approach of degrees of participation found in the PRGA framework (See Figure 1). The model is also hindered by the presumption that scientists and farmers are the only stakeholders that interact in a PPB programme. This fails to pick up on the differences between how plant breeders, social scientists, farmers and other stakeholders in the production and supply chain frame the plant breeding process, assume and devolve power, and communicate with each other.

Figure 1 - Opportunities for Farmer and Scientist Collaboration in Plant Breeding



N.b. F = Farmer. S = Scientist ★= involvement

Source: *Morris & Bellon, 2004*

Within the context of formal-led research, Morris and Bellon (2004) postulate that involvement during the generating diversity stage may only be necessary in terms of selection

of the source germplasm. The other stages, such as making initial crosses, and selecting in segregating generations; as well as further cultivar development may best be carried out by professional plant breeders. Both the 'selection of source germplasm' and 'testing varieties' stages can vary in the degree of farmer participation – from 'consultative' to 'collaborative'.

The basic premise behind the efficient PPB model is that the global centralised plant breeding system of CGIAR centres has certain advantages over national research and farmer-managed plant breeding systems due to its organisational and institutional structures. These advantages include research efficiencies derived from established practice and the elimination of redundant activities; extensive exchange of and access to germplasm; multi-locational testing in different countries; and the generation of spillover benefits to national/local plant breeding systems (Morris and Bellon, 2004:23). Conversely this same organisational and institutional structure confers certain limitations and shortcomings on the global system resulting in missed opportunities. These shortcomings include the limited amount of adaptive breeding activities for local environments; weak links to end users; and inadequate farm-level testing (*Ibid*.). Through the application of 'efficient PPB' these shortcomings can be addressed through localised projects while still retaining the advantages of the centralised international system. As such, this hypothesis, and the concept of efficient PPB as laid out in this paper, presupposes that efficiency be measured in relation to the specific goals and norms of the global (formal) plant breeding system and the resources and capital available to it (*Ibid.*). Be this as it may, the concept of 'efficient PPB' has more mileage outside of the international research system – depending on the institutional context and goals of the PPB project or programme, the degree of farmer participation at different stages can be scaled up or back as appropriate.

The concept of 'location' is primarily concerned with whether the constituent activities that make up plant breeding are carried out in farmers' fields or on the research station. The locus of crop improvement activities is of principle importance during the physical stages of the plant breeding programme, and as an issue, is closely linked to the degree of farmer participation at each of those stages.

With respect to 'location', the PRGA framework is open-ended regarding whether crop improvement activities are carried out on scientists' or farmers' land. Under the efficient plant breeding model a large proportion of the work is carried out on the research station with only the testing of finished varieties carried out by farmers. This is as expected since carrying out

research on farmers' land can incur greater travel and time costs for scientists, and farmers may also need to be reimbursed for their land hire and time. If PCI is being carried out on a project basis these costs will need to be borne by the research organisation on top of their regular research budget. One solution to this is to minimise the excess costs associated with a fully collegial participatory programme carried out solely on farmers' land, by limiting the degree, location and stages at which participation occur, or work with an intermediary NGO that has a presence in the target breeding area. In so doing, a research organisation can use its resources in an efficient manner and choose the stages, location and degree of participation that will yield maximum benefits, in line with the goals of the project, and at minimum increased costs.

What then are the potential benefits of carrying out crop improvement activities with farmers on their land? A central reason for deciding to use PPB is to address a phenomenon called genotype x environment x management (GxExM) interactions which can negatively affect the performance of crop varieties in farmers' fields (See Box 1).

Box 1 - Genotype x Environment x Management (GxExM) Interactions and PPB

Each new plant variety has been selected over time based on its performance in a particular environment. It has adapted to this environment, and if grown under similar conditions it should perform close to its maximum potential. However, if it is grown under conditions that fall outside of its adapted niche, it may underperform. The phenomenon of GxE 'crossover' occurs when one variety that would normally outperform another in its adapted niche, is grown in an environment where it is subsequently outperformed. An example of this would be if a newly released crop variety is grown in an environment where it is outperformed by an older inferior variety or by a traditional landrace. Agricultural scientists try to address the issue of GxE interaction by breeding broadly adapted varieties and prescribing an agronomic 'package of practices' (M) in order to bring farmers fields in line with the environment found on a research station.

The 'package of practices' approach prescribes an optimum crop management regime consisting of techniques, timings and external inputs such as fertiliser, pesticides and irrigation in order to create a homogeneous production environment that mirrors the one in which the crop variety was developed. One of the key focuses of plant breeders and agronomists is breeding plants which approach the maximum modelled 'yield potential' (YP) for a given environment. The difference between average and potential yields is termed a 'yield gap' (YG). There are three yield gaps that occur between potential and actual yields (Lobell et al., 2009). The first yield gap (YG_M) is the experiment yield and represents the best attempts of the breeder to approach the hypothetical YP. The second yield gap (YG_E) is the difference between the experimental yield recorded by researchers and the maximum yield farmers' achieve on their land. The third yield gap (YG_F) represents the difference in yields between maximum farmers' yield and average farmers' yield.

$$Y_M \geq Y_E \geq Y_F$$

YG_F and YG_E can be controlled through using a package of practices approach, but not all farmers have the knowledge, resources or money to do so. Moreover the cultivation methods may not suit their diverse livelihood needs. PPB can help minimise YGs and GxExM crossovers by breeding and selecting plants in the environments and under the management conditions of farmers in a particular area (Ceccarelli et al., 2000, Witcombe et al., 2005: 309). In the case of homogenous productive agricultural land, the theory of breeding for broad adaptation in target mega-environments is likely to be sound (Rajaram et al., 1995). If the target release environment is heterogeneous and risk-prone, then carrying out breeding activities on farmers' land can deal with GxExM issues can be addressed and yield other benefits derived from a farmer-scientist working partnership. Information from field environments and farmer management regimes gleaned from initial PRAs can be used in order to create 'managed stress environments' on-station thereby avoiding working directly in farmers fields, although this does not necessarily mean scientists will consider farmer management practices (M)(Bänziger and Cooper, 2001, Sperling et al., 2001).

2.3.1.3 Institutional Context

Sperling *et al.* (2001) designate institutional context as either formal-led or farmer-led. The institutional context relates to the locus of control within a PPB project or programme. Whether scientists or farmers take the reins of a project will determine which rules of behaviour, norms and values are adhered to, as well as the overall aims and objectives of the project. Formal-led PPB refers to those projects that are run by scientists and plant breeders in the formal crop improvement sector. Scientific values such as replicability, accuracy, explication, extrapolation, and generalisation of findings are important criteria in the formal system and the international academic community. The formal-led PPB approach has its origins in public-sector science bureaucracies, NGOs and some private-sector PPB projects. The farmer-led approach sees scientists and plant breeders as ancillaries supporting farmers' systems of plant breeding, selection and seed maintenance (*Cf.* Medina (2009)). The goal here is less "research efficiency", and more about allowing farmers to develop their goals and aims. Farmers also bear more of the burden of responsibility and cost when undertaking this mode of PCI.

In the Sperling *et* al. (2001) PPB characterisation, institutional context also includes information on the scale of research organisation, geographical coverage to date, and size of decision unit for managing the PPB – multi-community/regional or smaller. This descriptive information may be significant in terms of differentiating between how different organisations define goals and assign roles within a PPB project. However, this information only constitutes a part of the wider organisational and institutional context in which a project is embedded. The idea of institutional context as elucidated in Sperling *et al*. (2001) supposes that the division of farmer-led and researcher-led projects is useful as a descriptive and explanatory category. It is my opinion that this can be further expanded upon since PCI has often been carried out by development projects which have their own institutional context, and are not necessarily farmer-led or formal-led.

A question posed in Sperling *et al*. (2001) is whether PPB is scale-limited in farmer-led approaches on account of it tending to be conducted on a local or community scale. This may be because formal-led projects in organisations tend to have better international and academic links and employ methodologies that can be generalised yet rigorous enough to stand up better to peer review. In many cases researchers are accountable to the agencies which fund the breeding project. They therefore are obliged to report on what they have

found. It is also of note that PPB is seldom carried out by plant breeders themselves, but by social scientists, and that institutions which promote PPB are often not the ones responsible for plant breeding (Ceccarelli et al., 2003). A farmer-led project also has no obligation and little incentive to make its results known to the academic community (McGuire et al., 1999). Sperling *et al*. (2001:441) cite several examples of farmer-led PPB with broad geographical coverage, but they also state that the question largely remains unanswered due to the experimental nature of PPB at the time of writing.

The two most reported forms of PCI are the DPPB Barley programme of ICARDA and the PCI/COB projects of CAZS-NR and its research partners (Walker, 2008). Both these forms of PCI are closely linked to the formal sector: DPPB is a programme within ICARDA, a CGIAR international research centre, working closely with a number of National Agricultural Research Systems (NARS); and COB has been carried out as part of development projects involving partnerships between NGOs and agricultural universities. This latter series of COB projects exemplifies a form of PCI that occupies a space between formal- and farmer-led institutional contexts, i.e. PCI within development projects. In both cases, as in many other projects involving the formal-sector, collegial and farmer- / community-initiated forms of PCI are rare. This may be because these project and programme managers have some vested interest in the global formal crop improvement system, whether CGIAR centres or NARS. In this context, increasing farmer participation in research may be seen as a way of reforming plant breeding research to better understand the technology needs of the farmer demographic for which the new cultivars are being produced, as well as a means for potentially improving research efficiency.

Altering the established praxis and research paradigms of any bureaucracy is often an onerous task. There are many conceptual frameworks for how an institutional change might be effected by insiders or outsiders; but few which have been actively tried out, and fewer which have brought about the desired outcome (Pimbert et al., 2000: *passim*). Morris and Bellon (2004: 21) have listed a number of technical, institutional and economic challenges regarding the harmonisation of PCI methodologies within the global plant breeding system. The main technical issue listed is to do with the credibility of data generated through PPB methodologies. Morris and Bellon do mention that there have been efforts made to analyse PCI in the context of accepted plant breeding theory (Atlin et al., 2001, Witcombe and Virk, 2001); and they also state the experience of the formal sector engaged in PPB has enhanced belief in it (Bänziger and Cooper, 2001, van Eeuwijk et al., 2001). Professional plant breeders

and regulatory authorities in particular, may take issue with the type of data collected in PPB projects, especially that derived from subjective traits, due to its divergence from established scientific praxis, or perhaps even due to institutional bias.

A major economic challenge occurs in trying to combine the local and global approaches to plant breeding – at what stages can this be done to make it efficient; and how should resources be allocated? Answering these questions is hindered by the many variables that make up a plant breeding project, including the different institutional contexts in which PCI experiments and programmes occur. Three generally accepted benefits of PPB are that it can lead to increased adoption of modern varieties; generate varieties that are better suited to the target environments of an identified farmers' fields; and, has the potential to generate farmer and community empowerment. While there are generally accepted methods of estimating the benefits that come from increasing crop yield, the benefits linked to subjective traits, whilst important, have not been comprehensively evaluated in the context of PPB (Morris and Heisey, 2003); although methods for their evaluation have been published in a non-PPB context (Agbola et al., 2002, Baidu-Forsona et al., 1997).

An often understated issue is the question of how to measure research efficiency – what is the baseline. There is an implicit assumption that the formal crop improvement (FCI) system is the yardstick for measuring the efficiency of PPB against. Though, as mentioned previously, entrenched budget and organisational structures in FCI systems can unfairly skew any comparison in the FCI's favour. Finally there is an economic challenge associated with ensuring equitable compensation for farmers depending on the modes of participation that they are involved in.

In terms of institutional challenges there are the already stated issues of overcoming the different organisational, legal and regulatory hurdles associated with new modes of research. The above 'challenges' arise from the integration of two different systems of plant breeding and will be instrumental in deciding what form of PCI is permissible. The crux of this is that whichever group initiates or generates the project framework takes on the dominant role, and the other acts as supporters. This ties-in with Morris & Bellon's (2004) question about efficiency; or rather, if one group's norms frame and drive the project, what are the associated costs of involving the other group in the project? Do institutional norms generate inertia when introducing structural or procedural changes to a system? The latter question is particularly salient in the context of collaborative PPB and the differing concatenated power relationships

that exist between stakeholders. It is also relevant in the context of formal-led PCI that tries to engage with farmers in a collegial manner. Finally, there has been very little research into investigating just *how* PCI projects and programmes interact with FCI research systems, often treating these institutional cultures as an opaque 'black box' (McGuire, 2008).

2.3.1.4 Project Goals and Stakeholder Roles

'Goal setting' is an important planning phase within the crop improvement process. If it occurs close to the start, the process of articulating a crop improvement project or programme's goals can radically change its research trajectory and the stages, location and degree of participation that occurs. The explicit creation and statement of 'goals' can serve to differentiate a PCI project or programme from conventional plant breeding modalities, whose goals may remain implicit and unstated; and also helps define and condition the 'roles' of stakeholders, whether scientist, farmer or some other party, involved in the PCI project or programme. The roles of the various stakeholders in a PCI project or programme condition their power relationships and the relative stake that they have in the project, and their ability to influence it.

PPB was initially used as a tool to generate impact for non-commercial crops and in unpredictable heterogeneous production environments (Sperling et al., 1993a, Witcombe et al., 1996). It has subsequently also made inroads as a tool for creating new varieties for specialised niche markets (Chable et al., 2008, Mendum and Glenna, 2010). In both these cases it has been used in such a way as to orientate the breeding programme closer to the needs of a specific type of farmer, and as discussed earlier in this document, this has been done in a variety of novel and different ways. Sperling *et al*. (2001) have generated a table of potential PPB goals and possible indicators for whether those goals have been met (Table 4). They mention that some of these goals, i.e. production gains, are usually explicitly stated in all programmes; however there are others that are articulated poorly, if at all.

Table 4 - Potential PPB goals and possible indicators for monitoring progress towards them

PPB Goals	Possible Indicators
Production gains (includes quality increments and higher value products)	• Yield increases, stability • Faster uptake • Wider diffusion • Benefits gained through higher market value of product • Better identification of farmer-preferred subjective traits • Better performance of genetic material in worst conditions
Biodiversity enhancement/ Germplasm conservation	• Communities get wider access to germplasm • Communities get wider access to information/ related knowledge • More intra-varietal diversity • More inter-varietal diversity • Compatibility of new materials with existing ones. (Less varietal replacement, more compatibility with landraces) • Targeting of more micro-niches
Effective targeting of user needs	• Greater inclusion (of different kinds of users) relating to access and benefits • Higher degree of farmers' satisfaction • Broader range of users reached • Reaching of the most marginal (particularly women and the poor)
Cost-efficiencies	• Reduced research costs in relation to impact gained e.g.: acceptable varieties identified faster, fewer research dead-ends • More opportunities for cost-sharing in research • Less expensive means for diffusing varieties
Capacity building and knowledge generation for farming communities and the formal R&D sectors	• Improvement of links to strengthen farmers' access to sources of material and information • Changing relations/attitudes between communities and formal research systems • Enhanced farmer capacity to accurately breed (if needed) • Enhanced formal breeder understanding of the complexity of traits desired by farmers and of site-specific exigencies • Extensive knowledge dissemination: helping farmers become more aware of the formal system: e.g. letting them see (and judge) genebanks • Extensive knowledge dissemination: helping the formal system understand the nuances of farmer breeding and seed systems so as to more effectively plan joint work
Empowerment, Particularly of farming communities	• Changes in types of participation, in relationships between partners, e.g. depth of recognition of farmers' own breeding within this activity • Changing priorities or needs (e.g. farmers have equal voice in setting the joint breeding agenda): changes in patterns of decision making • Changes in access to and control over germplasm and information
Institutional and organizational innovation	• Identification of sustainable ways to decentralise • Identification of greater range of institutional partners • Clarification of strategies for scaling up *process* of PPB • Identification of options for moving and scaling up the *products* of PPB
Breeding program and seed policy modifications from expansion and institutionalisation of PPB	• Recognition of farmer varietal assessment/acceptability as a key condition of release • Formal release of site-specific materials • Support to localised seed multiplication and distribution enterprises • Strengthening and support to informal/local farmer seed systems

Source: Sperling et al. (2001)

Whether goals are stated or not depends on a number of factors such as the amount of resources available, budget structures, institutional and academic praxis/dogma, the crop in

question, the target production environment (TPE), and the socio-cultural and economic conditions of the participating farmers and communities. These factors can unite to constrain the articulation of some project goals making some of them mutually exclusive to each other. Since not all goals can be satisfied at the same time, and since goal setting is pivotal in defining the direction of the plant breeding programme, the relative importance of different goals will inevitably give rise to different forms of plant breeding. In a hypothetical idealised crop improvement system, the range of goals presented in Table 4 might be able to be incorporated with little or no conflict into one project or programme; or alternatively, be spread across multiple projects targeting different crops, types of farmers and farming systems. A typical non-participatory formal crop breeding programme is likely to contain less of the goals stated in Table 4 since PCI sets out to deal with a number of perceived potential shortcomings of conventional plant breeding. Morris and Bellon (2004) posit that the international (CGIAR) and national agricultural research systems (NARS) have different strengths and weaknesses.

There have been several claims made in academic papers documenting and supporting the use of PCI methods regarding the potential benefits that PCI research may have over conventional crop improvement processes (*Cf*. Ceccarelli and Grando (2007); Witcombe *et al*. (2005) and Witcombe *et al*. (2006)). The structuring of a PCI programme has the potential to yield research efficiencies through decreases in breeding time and increasing farmer adoption and dissemination of the finished varieties, *inter alia* (*Ibid*.). However, caution should be used in ascribing such potential benefits as project goals as it is possible that these benefits are contingent on project specific institutional contexts, and may differ if applied to another research system and its infrastructure.

According to Sperling *et al.* (2001: 448) there are a number of roles that farmers can assume when participating in a plant breeding programme. These include: provider of breeding material (local landraces); information provider (traits, farming system information etc.); input supplier (land and labour); management; and, trainer or skill builder. Stakeholder roles are a reflection of how the programme planners and managers value and view the skills that farmers have, and also how these skills can be utilised to achieve project goals.

2.3.2 Salient Events in the Development of PPB and PVS

According to a comprehensive PCI review carried out by Walker (2008), the terms PVS and PPB were not really introduced until the mid-90s. Prior to the emergence of PVS and PPB as methodological entities in their own right, the ground was being prepared through work carried out in the fields of participatory research and farming systems research from the 1970s onwards. He cited projects such as the national program of Guatemala (ICTA) that tried to institutionalise a mode of research which included on-farm trials and farmer-managed tests designed to elicit information directly from farmers that would be of use in technology design (Hildebrand, 1979). Another project that operated along similar lines was carried out at the prestigious Pantnagar Agricultural University in India. On-farm research was a key part of their maize breeding programme and a mechanism was devised to better link information from farmers to plant breeders so that it stood a better chance of influencing new plant breeding research priorities (Agrawal, 1979, Biggs, 1983)[4].

These early experiments in PVS-type methods co-existed with, and on the periphery of, conventional ToT crop improvement research. Walker (2008) suggests that there was undoubtedly far more FPR experimentation going on than was recorded in the literature, and that in some cases the FPR activity was not well characterised - *cf*. Morris *et al*. (1999b:8). The first published in-depth account of PVS activities concerned the activities of a CIAT bean breeding programme in Rwanda (Sperling et al., 1993a). Over the course of the project, farmers were invited to a research station to assess cultivars and select those that they wanted to take home (*Ibid*.). The paper documented the process and provided insights into the rationale behind farmers' selection criteria, as well as how and why they differed from those of the professional breeders. Two major points emphasised in the paper were that farmers have the capacity to outperform plant breeders in the selection of germplasm for use on their own land; and, that the involvement of farmers in the research process can reduce overall research costs (*Ibid*.).

An early account of progenitor PPB-type activities was recorded in an article written by Maurya and colleagues in 1988 (Maurya et al., 1988). Their work concerned improving rice breeding for rain-fed areas in eastern India through identifying the traits which farmers thought desirable in their traditional landraces, comparing these traits with advanced

[4] For a more in-depth account of these PCI progenitor projects please see Walker (2008).

breeders' material, and then providing farmers a selection of the material which best met their criteria for them to test on-farm (*Ibid.*). Although this was not strictly PPB by a contemporary definition, Dr. Maurya's work involved farmers earlier on in the breeding process than PVS did, and like PVS, farmers were directly involved with testing the new material on their farms under their own management conditions[5].

While there were different groups experimenting on farmer participation in crop improvement processes, there was not a definitive definition or classification of PPB, PVS, or PCI until an IDRC workshop in 1995 where all three acronyms were used (Walker, 2008). The following year the first of a series of four papers were published by Prof. John Witcombe, his colleagues at the Centre for Arid Zone Studies – Natural Resources (CAZS-NR), Bangor, and their research partners in India and Nepal (Witcombe et al., 1996, Joshi and Witcombe, 1996, Sthapit et al., 1996, Witcombe et al., 1999). In the first paper a key distinction was made between PVS and PPB in that the former involves farmer evaluation of near-finished or finished lines, whereas the latter involves the selection of genotypes by farmers from segregating generations, which is to say, earlier in the breeding process when the plant population being selected from has maximal genetic diversity (Witcombe et al., 1996). The earlier involvement of farmers in the breeding process allows for them to have more of an impact on the phenotypic qualities of the finished variety, which is particularly important if there are no current varieties available which suit farmers' needs.

The year 1996 also saw another milestone in the global development of PCI. After almost a year of planning by various parties, an international seminar was held at the International Centre for Tropical Agriculture (CIAT) (Biermayr-Jenzano et al., 2011). The purpose of the meeting was to consider important issues arising from the fields of participatory research and gender analysis[6], and consider how 'end-user' perspectives could be prioritised and mainstreamed by a highly-visible international research programme (*Ibid.*). The key outcome of the seminar was an agreement that resources and knowledge should be put in place in order to fund a programme to develop methodological tools, capacities and institutional strategies for participatory research. CIAT was to convene the programme and it was to be co-sponsored by three of its CGIAR sister organisations: the International Maize and Wheat Improvement Centre (CIMMYT), the International Centre for Agricultural Research in the Dry

[5] Further details of this and successor projects are listed as a case study in Weltzien *et al*. (2003:138)
[6] The role of gender in agriculture and its acknowledgement and inclusion in agricultural research agenda coincided with a rising global interest in FPR.

Areas (ICARDA) and the International Rice Research Institute (IRRI), as they would likely be users of the programme's outputs. An advisory board was convened consisting of elected representatives based on different interest groups considered as stakeholders, including: donors, NARS, IARCs, NGOs, indigenous knowledge systems, universities. Three decentralised working groups were established, each with a representative on the board.

- Plant breeding group (PBG)
- Participatory natural-resources management (PNRM)
- Gender Working Group (GWG)

Each working group developed a 5-year plan although gender issues were represented as a core issue within both the PBG and PNRM.

In December 1996 – the then Technical Advisory Committee of the CGIAR approved the establishment of the Systemwide Programme on Participatory Research and Gender Analysis (PRGA) which was subsequently created in 1997. The PRGA's prime mandate was, "to improve the ability of the CGIAR system and other collaborating institutions to develop technology which alleviates poverty, improves food security and protects the environment with greater equity. (Biermayr-Jenzano et al., 2011:14)." Each working group started with a five year plan to be enacted between 1997 and 2002, consisting of the following themes: methodological development, capacity building, fostering partnerships and networks, and, institutionalisation of methods across the CGIAR – later referred to as 'mainstreaming' (*Ibid*.).

According to Biermayr-Jenzano *et al.* (2011: 14), over the course of phase I, the PRGA and its partners argued that participatory research and gender analysis:

- "Employed and was grounded in robust scientific methodology, ensuring the validity of its work.
- Generated broad impacts by producing technologies and refining methods which met the demands and needs of end-users, increasing their uptake and mitigating their rejection by farmers.
- Was cost-efficient, primarily on account of its increased impact and shortened time for technology development and deployment.
- Are especially beneficial to women, the poorest and marginalized groups, all of whom were frequently overlooked by conventional research;
- Was being used by a large and growing number of CGIAR scientists, and there was growing (and unmet) demand for training in these methods".

One key activity carried out by both the PBG and PNRM working groups during phase I was the collation, development and analysis of two large project inventories of case-studies (*Cf*. Weltzien *et al*. (2003) and McGuire *et al*. (2003)). The PBG project inventory was, and remains, a valuable resource for helping to identify the achievements of PCI projects, analyse their similarities and differences, and to draw out lessons and examples of best-practice with which to formulate a typology or framework of PCI. The PPB inventory was an account of the global state of PPB at the time and consisted of 80 registered projects. There were many other projects that tried to register but were not accepted on account of their using participatory methods in an extension rather than research capacity. The inventories contained a wide array of projects differing in crop type, agro-ecological conditions and institutional contexts, although most projects were situated in marginal-subsistence oriented areas. The inventories helped in 'demystifying' the process of PCI, and as a reviewer of phase I put it,

> "... [the analysis of the inventory was] not to prescribe any particular type or mode as the correct one, but rather understand the effects of different modes of participation on the outcomes of research." (Saad, 2003:15)

There were three major published outputs of the PBG project inventory. Two large monographs were published after the end of phase I, one focusing on PPB from the perspective of formal plant breeding, and the other from the perspective of farmer plant breeding (Weltzien et al., 2003, McGuire et al., 2003). Both these documents were originally published in 1999 as PRGA working documents and the material within contributed to the third major published peer-reviewed output – a framework for analysing PPB approaches and results that was previously discussed under Section 2.3.1(Sperling et al., 2001).

Other than the project inventory work, the PRGA supported cutting-edge research through a competitive small grants scheme. In the first phase 26 grants were awarded across the three working groups (Biermayr-Jenzano et al., 2011). This gave the programme 'reach' across many different geographical areas, agricultural production systems, and helped to extend its research network and interaction with stakeholders (Biermayr-Jenzano et al., 2011). Each CGIAR director general also appointed a PRGA centre liaison who would disseminate information, research results and grant opportunities from the PRGA to their respective centre and its partners (*Ibid*.). The PRGA also provided learning and capacity building activities in participatory methods to both CGIAR staff and recipients of their small grant funding. During phase I the PRGA also regularly conducted international meetings, workshops and symposia,

and also maintained a Listserv mailing list. Saad (2003) mentioned the importance of the mailing list in helping to generate a code of ethics and best practices for PPB that would not put stakeholders at a disadvantage, and in the creation of a PPB and IPR guidelines document.

One major hypothesis that directed research during the first phase was that the publishing of empirical evidence of the benefits of FPR, including PPB, would stimulate researchers to experiment or adopt these methods and approaches. The programme therefore developed a range of methodologies with which to evaluate the impacts and costs of FPR (Biermayr-Jenzano et al., 2011). The outcome of this was a book that considered PPB and NRM in particular (Lilja et al., 2002). The thought behind the book was that the development and collation of carefully constructed impact studies would produce reliable scientific evidence that could support the cited benefits of farmer participation in crop improvement and stimulate its future wider use by research professions (Lilja and Ashby, 2002). In order to meet this aim, the book tried to address questions previously raised in another paper by Ashby (1996):

1. What degree of user participation is appropriate at a given stage in the innovation process?
2. What approaches to farmer participatory research and gender analysis (PRGA) are most effective for different types of technologies: e.g., knowledge or management intensive?
3. Are farmer PRGA approaches broadly applicable?
4. How do we measure benefits and monitor performance in relation to different goals (of various stakeholders)?
5. What are the costs?

In trying to provide impact assessment strategies, the authors were confronted by the multiplicity of aims and objectives for using participatory methods which lead to a diversity of potentially measurable impacts, e.g. process, technology, economic, efficiency, sustainability, empowerment criteria, etc. Another salient issue in participatory impact assessment arose in trying to differentiate between overall project outcome(s) and the specific contribution that 'participation' has made to it/them – there are often very few case studies that involve a counterfactual case to act as a baseline in which no participatory methods have been used. Lilja and Ashby (2002) also mentioned the dearth of cases that identified causal relationships between participatory activities and their purported impacts. In the book the authors present

case-studies and an impact assessment framework which tries to address these difficult issues (*Ibid.*).

The combination of different initiatives carried out by the PRGA over the course of its first phase was wide and far reaching. The information contained within the project inventories, the research network supported by its mailing list, the timely analyses derived from data acquired from these and other sources, and its position as a system-wide programme of the CGIAR, all contributed to its position as a leading global authority on FPR and PCI during this period.

The PRGA was not alone in its publication of PCI material. Of the major international agricultural research journals which publish articles on plant breeding, *Euphytica* and *Experimental Agriculture* have published by far the most papers on PPB and PVS[7]. In December 2001, the 122nd volume of *Euphytica* was devoted entirely to PCI. In the introduction to the PCI volume, the contributors state that it "...is believed that participatory crop improvement (PCI) possesses some essential advantages over formal crop improvement, such as a better definition of selection criteria that are important to the local community, and better targeting of environmental conditions (Elings et al., 2001)." Moreover they cite the project inventory work of the PRGA and a PPB workshop that took place in 1999 at Wageningen Agricultural University in the Netherlands as catalysts for bringing together a PCI dedicated issue (Weltzien et al., 1999). The main purpose of this PCI edition was to address the issue of how collaboration between farmers and breeders can best be organised, and the most appropriate breeding methods for realising this (Elings et al., 2001). The contributors included members of the PRGA as well as two other research groups who had devoted much of their activities to developing and implementing PCI (Ceccarelli et al., 2001, Witcombe et al., 2001). One of these groups, CAZS-NR and its research partners, had already been mentioned. The other consists of a decentralised participatory barley breeding programme operating across Syria, Tunisia and Morocco operating as a series of projects within ICARDA, a CGIAR centre. These two research groups represented the leading plant breeder practitioners of PPB and between them accounted for over half of the peer-reviewed articles on PPB (Walker, 2008).

[7] Other major plant breeding journals include *Field Crops Research*, *Crop Science*, and *Plant Breeding*.

I have so far presented an account of the emergence and establishment of PCI as a set of related crop improvement methodologies on the international stage. The next section considers the limited global mainstreaming of PCI methods and its status today.

2.4 The Limited Global Mainstreaming of PCI

PCI is a research modality that contains a critique of conventional ToT agricultural research and its ability to produce suitable crop varieties for a range of different farmers. As illustrated in Section 2.3.1, advocates of PCI prescribe greater participation of farmers in the research process as a potential solution for addressing the short comings of conventional agricultural research. Moreover, the stages, location and degree of participation as well as the roles of stakeholders and the goals of a project or programme may vary depending on the institutional context in which they are embedded. Since PCI methods can be applied in numerous ways there has been some debate as to whether farmer participation is required at every stage of the crop improvement process , and what forms a PCI project or programme might take in order to capitalise on the research efficiencies that working with farmers can bring in terms of reduced breeding time, greater adoption and lower overall research costs (Morris and Bellon, 2004, Witcombe et al., 2006).

2.4.1 Growing Critiques of 'Participation'

Having grown out of the larger field of FPR, PCI is closely linked to the principle of 'participation' and is thus inexorably linked to some of the wider criticisms of this concept found in the academic literature and development discourses. The Beyond Farmer First conference charted some of the concerns of invoking 'participation' in a populist manner without better considering the effects of inequalities in the relationships between individuals within communities, and between farmers and researchers or development practitioners (Scoones and Thompson, 1994a). In 1998 a symposium was held at the University of Manchester under the name, 'Participation: The New Tyranny?'[8] (Cooke and Kothari, 2001). This symposium recorded a number of *operational constraints* in trying to carry out participatory methods, and also *inherent problems* which emerge when participatory methods are used (Heeks, 1999). In describing participation as a methodological tyranny the

[8] This symposium resulted in a book containing a selection of edited conference papers, much like the Farmer First conferences.

symposium convenors made the point that, at the time, participatory development had become a largely unchallenged orthodoxy; and that although proponents such as Chambers called for self-referential appraisals of the participatory approach, these internal critiques were often limited to technological or personal application of the methods, and did not address systemic problems with the concept of participation (Cooke and Kothari, 2001: 13). However, despite using the word 'tyranny', the editors stated that:

> "... we would resist being labelled as anti-participation. There are acts and processes of participation that we cannot oppose. Some of these, such as sharing knowledge and negotiating power relations, may be part of everyday life; others such as political activism or engagement with social movements, are about day-today challenges and structural (for want of a better word) oppressions and injustices within societies. But it is also the case that acts and processes of participation described in the same way – sharing knowledge, negotiating power relationships, political activism and so on – can both conceal and reinforce oppressions and injustices in their various manifestations." (Ibid.).

The critique of participation mentioned above is largely focused on the principle of participation as applied in development projects. What then of farmer participation in FPR? Like participatory development, FPR had not been exempt from criticism, and often FPR features as part of development projects, and because of this, can be subjected to similar critiques. Bentley (1994: 143-144) listed the following barriers to farmer-scientist collaboration in FPR:

1. Farmers are difficult for scientists to reach if situated far from a research station.
2. Farmers and scientists have different observation styles.
3. Farmers and scientists have different experimental styles.
4. Farmers and scientists have different economies (assigning value).
5. Scientists have many work tasks other than overseeing participatory activities (*Cf*. 'Economics of Attention' – Tripp (2009)).
6. There are many local natural environments each with unique research needs. Scientists have limited time and money and seek to act in a utilitarian way when assigning research priorities.
7. The social distance between scientists and small-scale farmers is greater than between scientists and more prosperous farmers.

In spite of the aforementioned barriers, Bentley (1994) argued that the participatory involvement of farmers in agricultural research was still important with respect to setting

research agenda; although he provided the *caveat* that in his experience it required significant investment in new methodological training, and was best carried out by full-time professionals or dedicated intermediaries. Bentley's list (above) provides some suggestions for why greater degrees of collegial participation do not often occur naturally between scientists and farmers.

As a form of FPR, and more specifically PTD, PCI is both subject to some of the more general critiques of participation outlined above. However, it should not be conflated or subsumed totally within the field of participatory development since there may be many goals and objectives to a PCI project or programme that fall outside of development and farmer empowerment. If one considers agricultural research systems, PCI can be useful for setting research agenda through better targeting the GxExM of different types of farmers and improving the uptake of new agricultural technologies.

Some PCI practitioners have gone as far as altering the terminology, exchanging the term 'participatory' for 'client-oriented' breeding (COB) (*Cf*. Witcombe *et al*. (2005), Witcombe *et al*. (2006), and, Witcombe *et al*. (2009)). This change in nomenclature resulted from the experiences of these practitioners in trying to collaborate with scientists in NARS. COB dispenses with the term 'participation', which may have dichotomous connotations, and repackages PCI in terms of a scale of more or less-client orientation. Under COB, direct farmer involvement may still occur as part of the crop improvement process, but whether it is appropriate or not is decided by the persons managing the project (*Ibid.*).

In spite of the critiques to its methodological orthodoxy, participatory development persists in many forms to this day (Hickey and Mohan, 2004). The critiques it has faced have tempered its ascendency and challenged its status as a *panacea* for addressing the short comings of previous development methods and models (*Cf.* Chambers (1981)). However, many of the underlying issues that participatory methods initially sought to address remain problems to this day, and although greater participation might not solve all problems, and may even cause some of its own, it is still a means of reorienting research systems to better consider the needs of people who are otherwise invisible to it (Chambers, 2008b). While acknowledging some criticisms of participatory methods, it seems that Chambers perceived 'Participation: The New Tyranny?' as an overly negative critique that was in part derived from the contributors' "own defective practices" (Chambers, 2008a: 300). He is more in favour of the stance advocated in a more recent book, 'Participation: From Tyranny to Transformation? Exploring New Approaches to Participation in Development' (Hickey and Mohan, 2004), which seeks to address some of

the concerns outlined in the earlier book in light of more recent experiences (*Cf.* Chambers (2004)).

2.4.2 The Farmer First Movement and PCI Today

In December 2007 the Institute for Development Studies (IDS), University of Sussex, hosted another Farmer First conference called 'Farmer First Revisited' (Scoones and Thompson, 2009). It had been nearly 20 years since the previous conference, and Farmer First Revisited aimed to document how FPR had developed over this time. Many of the underlying premises on which FPR had been built on remained relevant. However, practitioners were applying FPR to broader contexts and policy issues – no longer was the focus solely the farmer or farm. Issues such as climate change; the functioning of agricultural research networks and partnerships; new economic relationships and markets; farmers' organisations; public-private partnerships (PPPs); *inter alia*, were also being investigated (*Ibid*.)[9].

It is of particular note that several papers were presented on institutional learning and organisational change, and why FPR methods and approaches had not been institutionalised within NARS and the international agricultural research CGIAR system despite international efforts to develop and scale them up (Ashby, 2009, Scoones and Thompson, 2009, Ortiz et al., 2009, Sulaiman, 2009, Hall, 2009, Watts and Horton, 2009). More recently the 'participation agenda' has been framed as a component in a broader 'contested agronomy' in which different movements have opened up 'spaces' for the contestation of agricultural research and policy approaches (Sumberg and Thompson, 2012). The continued co-existence and contestation of the merits of PCI by and within agricultural research institutions points to more specific research being needed to better identify the constraints and opportunities for its uptake and greater use within these same institutions. McGuire (2008) has published research that highlights the importance of trying to unravel the institutional 'black boxes' of agricultural research systems in order to better understand their limited uptake of PCI. However, this research topic remains largely unaddressed and it is the goal of this thesis to provide more information on the barriers and opportunities for introducing PCI into public plant breeding systems.

[9] Surprisingly Farmer First Revisited makes no mention to the broader debate on participatory methods discussed in Cooke and Kothari (2001) and Hickey and Mohan (2004).

This goal is particularly relevant since accounts of the application of PPB and PVS (PCI) methods continue to be regularly published in academic journals[10]. There are also extensive accounts of PCI experiences available online, in formats such as project papers, working documents, and book chapters, *inter alia*. Bibliometric searches of the terms 'Participatory Plant Breeding' and 'Participatory Varietal Selection' on Scopus, Web of Knowledge and Google Scholar, reveal that the most prolific authors for these terms are identified with the two major groups that have worked consistently with PCI methods: CAZS-NR and ICARDA participatory barley breeding. Both these research networks have been operating for a sustained period of time, and many of these core PCI practitioners are on the verge of retiring or have retired[11].

The future of PCI at CGIAR centres also hangs in the balance. At the beginning of 2010 the CGIAR began a period of restructuring and the System-wide and Eco-regional Programmes, which included the PRGA, were shut down (Biermayr-Jenzano et al., 2011). The PRGA was initially incorporated within the International Centre for Tropical Agriculture (CIAT), with a view to benefiting the research programmes of the centre. Shortly after its move to CIAT, staff at the PRGA held a conference and survey to assess the ongoing demand for PCI and gender-sensitive research within the CGIAR in order to try and define a new role for the programme (Alvarez et al., 2010). However, by mid-2011 the PRGA programme had folded (Biermayr-Jenzano et al., 2011). The reasons for this were two-fold. Firstly, the PRGA found it difficult to get its concept notes for future projects funded during the CGIAR restructuring process; and secondly, donors expressed their preference that the CGIAR adopt a gender strategy at the System level (*Ibid.*: 12). A subsequent gender scoping study was carried out within the CGIAR to make sure that all consortium research projects included a sound gender strategy, and this led to the closure of the PRGA by CIAT (*Ibid.*).

During the second phase of the PRGA (2003-2010) the focus of the programme had been more on gender-sensitive research rather than FPR and PPB that had achieved more focus in the first phase. Although gender focus is now potentially mainstreamed within CG centres, this is not the case of PCI, and a lack of an organisation such as the PRGA will not help efforts to institutionalise and coordinate international research into PCI. PCI research now stands at a crossroads where the old guard who pioneered and developed the methodology have tried to institutionalise it to limited effect. It is perhaps time for a new wave of academics and

[10] Substantiated through searches on Scopus and Web of Knowledge on 1st February 2013.
[11] Retired footnote: Ceccarelli has retired from ICARDA. CAZS-NR Virk is on a zero hour contract and there are few full-time staff. DFID is not currently funding CAZS-NR PCI initiatives.

practitioners to look into the efficacy of PCI and see why it is not used more often in agricultural research organisations.

3 Conceptual Framework and Methodology

3.1 Introduction

The previous chapter reviewed the development of participatory crop improvement (PCI) methodologies and their contributions to a debate on the merits of farmer participation in research (FPR) and policy making. This debate has in-part shifted towards trying to explain the factors which account for the mixed results experienced by practitioners in trying to scale-up and institutionalise FPR and 'Farmer First' methodologies within agricultural research institutions around the world (Ashby, 2009).

This chapter examines a number of theories and frameworks that may be of use in analysing the concept of 'institutionalisation' with respect to PCI. These theories will in turn act as possible lenses with which to focus in on potential factors that could constrain or provide opportunities for PCI institutionalisation. Specific literatures to be considered and evaluated with respect to their potential utility include strategic niche management (SNM) and learning-based development approaches (LBDA). Although these literatures contain potentially useful principles, ideas and methods of inquiry, they have also been formulated from the empirical experiences and resultant analyses of researchers investigating overlapping but different contexts and phenomena. It is therefore important to address the limitations of these theories and approaches while also demonstrating how a selective synthesis of them may be used to illuminate the salient factors related to the scaling-up and institutionalisation of participatory plant breeding.

After presenting the conceptual framework, this chapter will frame the research questions before laying out the research strategy and methods of data collection. The chapter finishes with a consideration of research ethics as applied to this thesis and a statement regarding the funding that has supported me in this process.

3.2 PCI: Conceptualising 'Institutionalisation'

The central concern of this thesis is an investigation into the factors which limit and provide opportunities for the institutionalisation of PCI initiatives within public sector agricultural research institutions. In defining the term 'institution' I follow a general definition employed by Sulaiman (2009) which refers to the rules, norms and working practices which govern how

affiliated agricultural research and extension organisations carry out their activities – in this case crop improvement. By extension 'institutionalisation' is therefore the process of establishing something, typically a practice or activity, as a convention or norm in an organisation or culture[12].

What then does institutionalisation refer to with respect to PCI; why is it important, and to whom? If one considers the general definition above it appears self-evident that 'institutionalisation' would refer to the normalisation of PCI methodologies, such as PPB and PVS, within research organisations such as the Indian NARS. However, as demonstrated in the previous chapter, PCI consists of a suite of methodologies that can be deployed selectively and to different degrees depending on the context. So what might PCI research look like in a public sector agricultural research institution? It might not necessarily take the 'projectised' form of research seen in many experimental or development projects, but instead might consist of a modification of current plant breeding processes to be more client-oriented depending on institutional limitations. This will have implications for those stakeholders who are promoting institutionalisation as a desirable project goal or outcome. If this is the case it would be useful to characterise other potential variants of what institutionalised PCI might look like and some pathways or strategies for working towards them.

The concept of institutionalisation may also be promoted by different stakeholders for different reasons. If one considers academic and farmer democracy movement advocates of Farmer First and FPR methodologies, their investigation into the strategies for institutionalisation was a result of their continued contestation and marginalisation, or limited/partitioned co-existence of the methodologies within agricultural research institutes (Chambers et al., 1989, Scoones and Thompson, 1994a, Desmarais, 2002). The rationale which frames Farmer First and FPR as a counter-narrative to address the limitations of a top-down, expert-led, and supply-driven ToT research agenda has remained strong, so why has it not transformed research bureaucracies?

From the perspective of donors funding PCI projects, however, the reasons for promoting institutionalisation may be seen differently. The funds that donors disburse to development and research projects need to be accountable to the public and politicians; hence projects are required to be good value-for-money. Whether a project is deemed successful in this respect

[12] Adapted from OXFORD DICTIONARIES 2010. "institutionalize". *Oxford Dictionaries.* Oxford University Press.

depends on its 'impact' which is loosely linked to the number of beneficiaries that a project generates and the degree to which they are affected by the outputs of the project. An important factor from the perspective of the donor is what happens to these benefits when the project funding is withdrawn. At the culmination of a project, do the benefits persist independently of project funding and activities, or are they ephemeral: here today and gone tomorrow? The sustainability of project impacts, as seen through this economic lens, became an important criterion for donors in constructing project success (Farrington, 2001, Winters, 2010, ICAI, 2011).

As suggested above, the reasons for promoting the concept of institutionalisation differ depending upon the belief structures and motivations of different stakeholders. The set of PCI methodologies may also be normalised within research organisations in different ways depending on the institutional context. The rest of this chapter will investigate some literatures which are of use in directing attention towards factors which may facilitate or impede the normalisation of PCI in agricultural research organisations.

3.2.1 Strategic Niche Management (SNM)

The concept of a socio-technical system has been used to characterise and define agricultural and plant breeding systems (Thompson and Scoones, 2009, Wiskerke, 2003, Chiffoleau and Desclaux, 2006, Hebinck, 2001). The term "socio-technical system" in relation to plant breeding refers to the production of plant varieties (artefacts); how they are regulated, distributed and marketed to farmers; and the ways in which they are used or cultivated by farmers (Geels, 2004). In general the dominant form of socio-technical system, also known as a regime, can be thought of as,

> "...mutually reinforcing cognitive, technological, social, economic and institutional processes [that] channel the development of practices along certain trajectories, affected by a complex structure of artefacts, institutions, and agents." (Scoones et al., 2007: 19)

This represents a more nuanced concept to describe a plant breeding research system than a set of organisations and institutions.

SNM academics are concerned with understanding the processes by which new innovations can be nurtured along sustainable trajectories, or socio-technical transitions, towards their

establishment within the dominant socio-technical regime (Schot and Geels, 2008). The core idea is that new innovations are faced with numerous barriers between their research and development and eventual adoption. A core principle of SNM is that these innovation journeys can be facilitated through the "modulation of technological niches" (*Ibid.*). Schot and Geel's define a 'technological niche' in SNM as, "protected spaces that allow nurturing and experimentation with the co-evolution of technology, user practices, and regulatory structures." (*Ibid*.). A technological niche is a protective and facilitating environment that arises from the cooperation of stakeholders engaged in a form of reflexive self-government to develop and promote the technology or innovation in question.

A technological niche can be thought of as being influenced by factors, both internal and external to the niche, which affect its ability to transition desirable innovations to a more stable setting within the socio-technical regime. Schot and Geels (2008) list the following three major niche internal factors: the articulation of expectations and visions, the building of social networks, and learning processes at multiple dimensions that also engage in reflections on cognitive frames and assumptions. Early SNM work tended to focus on internal niche processes needed for successful technological niche development (*Ibid.*). Subsequent work has refined these niche development factors and shifted the focus to consider niche external processes (Schot and Geels, 2008). These can be conceptualised as a broader socio-technical regime consisting of institutions whose entrenched *modi operandi* influence product development trajectories. The socio-technical regime is in turn understood as nested within a wider socio-technical landscape which it does not directly influence but which may impact on it. Niche-actors wanting to get their innovations adopted by the regime or alter an element of it are faced with the difficulty of altering deep-set institutional norms and technological lock-in.

This multi-level perspective (MLP) posits that socio-technical transitions can be brought about through the interactions of processes at different levels i.e. bottom-up initiatives from the niche level and top-down pressures from the technical-landscape level can destabilise the socio-technical regime enough for niche innovations to be incorporated into it. Raven (2006) has argued in the case of the Dutch energy sector that niche innovations can be adopted by the regime to solve a particular problem. Through sharing knowledge and learning processes, the actors involved in the development of niche innovations and those involved within the regime have the opportunity to collectively reconfigure the regime in order to stabilise their

roles in it. They do not therefore have to supplant the current regime but can work alongside other innovations in the regime to fulfil a particular need.

If one considers the different levels of the MLP, the technological niche may be seen as the micro level, the socio-technical regime as the meso level, and the socio-technical landscape as the macro level of a system. The levels of niche and socio-technical regime have already been discussed above by Schot and Geels (2008). The wider socio-technical landscape is described as, "an exogenous environment beyond the direct influence of niche and regime actors (e.g. macro-economics, deep cultural patterns, macro-political developments)" (Schot and Geels, 2008). Although the niche and regime are unable to directly influence the socio-technical landscape, the landscape has the potential to influence the interactions between the niche and regime by destabilising the regime and creating windows of opportunity for the regime to adopt niche innovations (Geels, 2011).

3.2.2 SNM as a Model for PCI Institutionalisation

SNM was initially developed to address the issues of 'niche' transition from 'technological niches', consisting of an enabling experimental environment for innovative product design, to 'market niche' and eventual adoption by an existing 'socio-technical regime'. These terms may have potential for use in a model for analysing and explaining PPB institutionalisation; however they need to be redefined in order to fit better the situation of PPB/COB.

Although SNM focuses on "socially desirable innovations serving long-term goals such as sustainability" and "radical novelties that face mismatch with regard to existing infrastructure, user practices, regulation, etc.", the term 'innovation' used in SNM tends to be used to refer to products rather than to innovative methodological reforms such as PCI (Schot and Geels, 2008:539). Within SNM there is also a focus on market niche generation, which in turn is dependent on stabilising and refining the technological niche and understanding user demand for the product. Articulating user demand is central to PCI, however, the focus of global PCI niche development has been less on commercialising the process, but rather on improving the accountability of the crop design process to end-users, the farmers, by creating more suitable crop varieties than are currently available. Despite the original market focus, SNM provides a potentially useful set of theories and hypotheses for studying possible transformations of research bureaucracies within a socio-technical regime. The niche commercialisation aspects

of SNM can be modified for a more sociological focus that is more suitable to the nature of PCI innovation.

PCI has arisen out of global experiments in participation to form what may be considered a global technical-niche – as defined in Geels and Raven (2006). These projects were carried out on a local level and their published outcomes continue to refine and improve the collective understanding of PCIs strengths and weaknesses – *Cf.* (Witcombe et al., 1996, PRGA, 2003, Mustafa et al., 2006), *inter alia*. Over time pressure has been exerted from the 'technological landscape' via international donors, academic communities and activists onto the international socio-technical regime of crop improvement to improve factors such as efficiency and accountability. This has created opportunities within local research bureaucracies to experiment with PCI methods. However, in spite of these opportunities strong barriers to PCI institutionalisation remain within many regional socio-technical regimes. In spite of the progress made by certain public research bodies which have adopted PCI experimentally, or as a means to address particular crop improvement problems, the ongoing role of PCI methods in socio-technical regime reform is still under debate (Morris and Bellon, 2004). In particular, how actors within the global technological-niche of PCI can best promote the principle of client-orientation – reforming the socio-technical regime in order to make it more efficient; or as a particular methodology to address specific demographics such as the rural poor (PRGA, 2003).

The term 'technological niche' described as "protected spaces that allow nurturing and experimentation with the co-evolution of technology, user practices, and regulatory structures" fits the way in which PPB has been experimented with by different people on a global basis (Schot and Geels, 2008:538). Within this global PPB technological niche, John Witcombe *et al*. Have, along with other stakeholders, participated in the evolution of PPB methods. There are many similarities in approach between different PPB experimental groups; however these groups often do not work closely together. Although they may contribute to the debate on plant breeding methods and share their empirical findings in academic journals and at conferences or symposia; they often act individually and sometimes competitively in terms of the geographical regions in which they operate and their quests for sources of funding. Schot and Geels (2008) also mention the possibility of competition between projects within a niche, stating that as a result of this, "actors may not be willing to share learning experiences. Secrecy may hamper the circulation of lessons and experiences." This is especially true of news that could cast the project in a negative light with respect to

future funding, i.e. problems with scaling-up and institutionalising PPB/COB. From this it can be inferred that, in the context of an SNM model, there can be a number of similar PPB technological niches interacting with a number of similar but distinct socio-technical regimes operating in these different geographical areas. Moreover there is a temporal aspect that needs to be considered with respect to the evolution of a PCI niche. The niche can build on the work of previous PCI projects and may consist of more than one project operating together at any one time. With respect to the PCI work carried out in India by DFID and CAZS-NR, the socio-technical regime that the PCI niche interacts with has been the Indian public plant breeding system. This regime is complex and made up of both federal and state-controlled organisations, potentially complicating any effort made towards scaling-up and institutionalising PCI.

Since the formation of a 'market niche' is not an explicit feature of PPB goals this niche evolutionary transition can be discarded from the modified model. PPB is an innovative plant breeding method in which the process of determining the needs of farmers (end-users) is an explicit aspect of the method. However, the concept of a 'market niche' is not without relevance if one considers the end-users to be not just the farmers but also the plant breeders and powerful policy making stakeholders. It is these actors who will ultimately decide whether PPB is useful and adopt it or not. It is important that PPB addresses the needs of plant breeders and the constraints of the environment in which they operate if it is to be successfully adopted on a wider scale.

The majority of case studies in the SNM literature concern industries which produce novel marketable products. The products of plant breeding are novel plant varieties; however the market for these products is underdeveloped making it difficult for the projects to fund themselves. PCI has been represented as a pro-poor research methodology because it addresses those farmers not served by the interests of the private plant breeding companies who aggressively target the more 'progressive' farmers with varieties, such as hybrids and biotech, from which the companies can get a good return on their investment (Weltzien et al., 2003). Since private companies already cover the 'progressive' farmers' share of the market, it is understandable that the public plant breeding regime should direct some of its efforts towards targeting farmers and crop varieties that are not currently served by the private sector (Morris et al., 2006: 38). The case for institutionalising PCI or a more client-oriented form of breeding within the public sector system is a strong one in terms of redefining the role

of the public sector to be more complimentary to the private sector; but also because there are currently few viable ways of funding sustained PCI activities outside of the public sector.

PCI niches can also be seen to have internal and external factors which affect their ability to transition to a more stable setting within the public plant breeding regime. Schot and Geels (2008) list the following three major niche internal factors:

1. The articulation of expectations and visions. Expectations are considered crucial for niche development because they provide direction to learning processes, attract attention, and legitimate (continuing) protection and nurturing.
2. The building of social networks. This process is important to create a constituency behind the new technology, facilitate interactions between relevant stakeholders, and provide the necessary resources (money, people, expertise).
3. Learning processes at multiple dimensions:
    a. Technical aspects and design specifications
    b. Market and user preferences
    c. Cultural and symbolic meaning
    d. Infrastructure and maintenance networks
    e. Industry and production networks
    f. Regulations and government policy
    g. Societal and environmental effects

Subsequent work on the niche internal factors that contribute to successful niche building have elaborated on the three main niche-internal factors as follows (*Ibid.*):

1. Expectations would contribute to successful niche building if expectations were made:
    a. More robust (shared by more actors),
    b. More specific (if expectations are too general they do not give guidance),
    c. Have higher quality (the content of expectations is substantiated by ongoing projects);
2. Social networks are likely to contribute more to niche development if:
    a. The networks are broad, i.e. multiple kinds of stakeholders are included to facilitate the articulation of multiple views and voices; the involvement of relative outsiders may be particularly important to broaden cognitive frames and facilitate second-order learning;

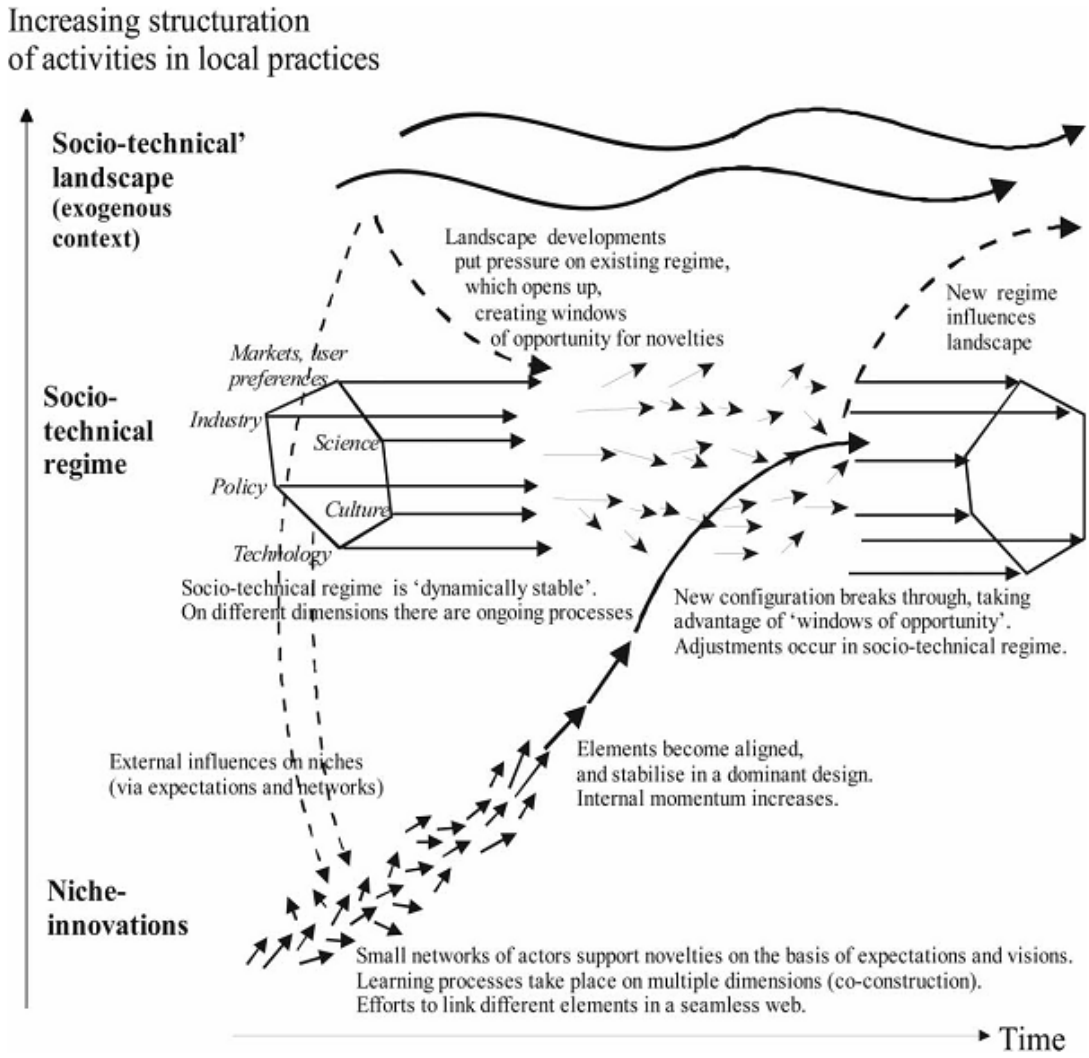
   b. The networks are deep, i.e. people who represent organisations, should be able to mobilise commitment and resources within their own organisations and networks;
3. Learning processes would contribute more to niche development if they are not only directed at the accumulation of facts and data, i.e. first-order learning, but also enable changes in cognitive frames and assumptions, i.e. second-order learning (derived from Grin and van de Graaf (1996)).

With respect to PPB/COB there are two major points to be taken from the above list of niche-internal factors. The first is that SNM hypothesises the importance of individual projects not 'going-it-alone'. It is suggested that in order for strong niche development there needs to be communication between different projects and a collaborative articulation of goals. Schot and Geels (2008:541) state that, "Failed niche developments could often be related to either minimal involvement of outsiders in the experiments and a lack of second order learning, or to minimal involvement of regime actors which resulted in lack of resources and institutional embedding". Secondly, social networks should play a central role in developing the technological niche. In this respect PPB niches should include multiple stakeholders from a range of backgrounds in order for it to develop in such a way that considers the problems and limitations that different persons and organisations might also have in applying PPB. This second point, though classified in SNM as a niche-internal factor, is maybe important as a niche-external factor, with respect to how different projects engage with the socio-technical regime and the environment within which the regime is embedded.

While SNM work "... has identified and empirically investigated important niche-internal mechanism in sustainable innovation journeys", Schot and Geels (2008:545) review acknowledges that, "niche innovations are rarely able to bring about regime transformation without the help of broader forces and processes". In order to address these issues research has concurrently been carried out on niche external processes, which are also known in the literature as the Multi-Level Perspective (MLP) concept (*Ibid.*). The core principle of MLP, "is that [niche] transitions come about through interactions between processes at different levels: (a) niche innovations build up internal momentum, (b) changes at the landscape level create pressure on the regime, (c) destabilisation of the regime creates windows of opportunity for niche innovations" (*Ibid.*:545). Within MLP the technological niche is seen as the micro level; the socio-technical regime as the meso level; and the socio-technical landscape as the macro level of a system. The niche level and the factors affecting its formation have already been

discussed above. The concept of a socio-technical regime refers to the "regulative rules and normative roles" that govern an institution, in this case public plant breeding, as well as the organizations and their "cognitive routines and belief systems" that support and perpetuate the regime (*Ibid.*:545*)*. The wider socio-technical landscape is described as, "an exogenous environment beyond the direct influence of niche and regime actors (e.g. macro-economics, deep cultural patterns, macro-political developments)" (*Ibid.*:545). Schot and Geels (2008) state that landscape change is difficult for one niche to achieve and slow, often taken decades for change to occur. The MLP concept is illustrated graphically in Figure 2.

Figure 2 - Multi-Level Perspective on Niche-Regime Transitions



Source: (Schot and Geels, 2008)

While MLP may have been used to explain other forms of sustainable niche transition, it is not as relevant to the COB WIRFP situation in its current form. As I suggested earlier, PPB niche projects tend not to work closely together. Furthermore they tend to operate in distinct

geographical locales with different socio-technical regimes. The probability of any one PPB niche exerting a change on the socio-technical landscape to disrupt the socio-technical regime is very low. Some landscape pressure has in the past been exerted on socio-technical regimes through a favouring of the concept of participatory research and rural livelihood development by development agencies and funds.

This chapter has so far looked into the appropriateness of SNM as a meta mental model for investigating factors that may affect the institutionalisation of PCI within agricultural research systems. Although niche internal factors have been outlined above, at this point I have not discussed niche external factors. Figure 2 represents a socio-technical regime as a dynamically stable configuration of markets, user preferences, culture, industry, science policy and technology. The next section on learning-based development approaches will discuss how specific theories and concepts within this diverse literature may be of use in better characterising niche internal factors and considering the management of boundaries between niche and regime.

3.2.3 Learning-Based Development Approaches (LBDA)

SNM provides a conceptual model and what SNM case-study analysts might call examples of best-practice for strengthening the niche and destabilising the regime with a view to integrating the novel technology or process developed by the niche into the regime. Similarly, LBDA consists of a body of literature that considers the concepts of institutionalisation and sustainability, but with respect to development project interventions. The purpose for considering LBDA as well as SNM is that LBDA has arisen out of the experiences of development projects which inhabit similar socio-economic and institutional contexts to the situations under which PCI has been developed. SNM case studies, on the other hand, are largely concerned with the experiences of Western industrial innovation. In the section below I will show that despite the differences in their origination, both SNM and LBDA have distinct but complimentary approaches that can work well together in examining the factors that may influence the institutionalisation of PCI methods.

The initial suggestion that LBDA and SNM may be complimentary approaches was made by Romijn *et al*. (2010). They reviewed four biomass energy experiment projects in rural India and suggested that, in the context of development projects, SNM and learning-based development approaches are complimentary analytical frameworks for investigating the issues

surrounding scaling-up and institutionalising the projects within larger socio-technical regimes (*Ibid.*). In general the authors' findings were that the strengths of SNM are "its explicit conceptualisation of environmental sustainability and its endogenous treatment of larger contexts"; whereas LBDA were more specialised in dealing with the "complexities of local management and stakeholder organisation" including the power dynamics that exist between stakeholders (*Ibid.*:326). In reaching these conclusions the authors undertook a review of learning-based development literature focusing on the work of Korten (1980), Douthwaite (2002) and Uphoff *et al*. (1998), whose contributions they found to be complimentary to each other. Table 5 shows a summary of their broad comparison of LBDA to SNM approaches.

From their synthesis of LBDA and SNM, the authors found that within the LBDA literature there is often a strong focus on the self-reliance, emancipation and empowerment of local stakeholders (Romijn et al., 2010). With respect to PCI methodologies, the degree of farmer empowerment and sovereignty over directing future plant breeding research may be diminished through engaging with the public plant breeding regime. While farmer-relevant plant varieties may be bred through PPB/COB, ongoing farmer empowerment is attenuated if the approach is not scaled-up or institutionalised within public plant breeding institutions. In attempting to analyse PPB/COB, the focus is less on farmer empowerment and farmers sustaining PPB/COB by carrying it out themselves, and on how PCI project partners interact with each other and public plant breeding organizations to promote, scale-up and institutionalise the PCI methodologies. Despite this difference of focus, because the unit of analysis of LBDA tends to be the project, its interactions and how it is structured, these approaches may contain features and examples of good practice that can be adapted to investigate PCI projects.

Table 5 - Main Similarities and Differences between SNM and a Learning-Based Framework

	Strategic Niche Management (SNM)	**Learning-Based Development Approaches (LBDA)**
Main goal and perspective	Study *socio-technical transitions towards environmentally more sustainable systems of provision.*	Understand *how poverty can be eradicated and local communities strengthened* through project/programme interventions aimed at learning and capacity building for *self-reliance, emancipation, and empowerment.*
Conceptualisation of sustainability	Economic viability and socio-institutional embedding of new technologies and practices seen as instrumental towards reaching *environmental sustainability* end-goal.	Achievement of *socio-institutional sustainability* (increase in local capacity and resources for independent problem-solving and learning) has been main focus. Recently increasing attention to environmental sustainability issues, but this aspect still not well integrated into framework. Economic viability mainly seen as instrumental towards meeting socio-institutional aims.
Unit of analysis	*Niche*; experiments seen as means to create niches.	*Development projects/experiments*; limited analytical attention to linking experiments in niches.
Conceptualisation of 'niche-level'/project-level dynamics	Ongoing *learning, networking and articulation of expectation* seen as main driving processes. Little attention to organisational and management issues in these processes.	*Ongoing learning* seen as main driving process. Less elaborate treatment of inter-stakeholder networking and mostly implicit treatment of expectations dynamics. Detailed attention to *organisational and management processes*, esp. To learning culture in organisations, leadership qualities, participation issues.
Attention to context of experiments/projects	Key *endogenous* feature of framework. Innovation-inducing and retarding factors at niche level emanating from larger context (regime, landscape) *conceptualised and analysed in detail* (with reference to path dependency, inertia, etc.), as are niche-influences on larger context of landscape and regime.	*Limited attention*. Context mainly treated as *exogenous*; not an integral part of framework itself.

Source: *Romijn et al. (2010:334)*

Romijn *et al*. (2010) identify the following features of good practice in LBDA that are linked to interactive learning processes, project management, and stakeholder empowerment :

- **Project design and management practices** (planning and technology choice, pilots, resource mobilisation, incentive creation, capability building, planning for expansion and diversification, organizational learning and knowledge management)
- **Management culture of the project-implementing organization** (reflexive and adaptive learning, effective knowledge management, short lines of communication, minimal bureaucracy)
- **Leadership characteristics** (of prominent stakeholders)- See troika model of leadership (Hauschildt, 2003, Ancona and Caldwell, 1992).
- **Principles of participation** – active engagement and empowerment of *plant breeders* as well as farmers
- **Broader-project implementation context**, **especially institutions and culture**.

This latter point on the broader project implementation context may be particularly relevant for understanding how the PCI project(s)/niche interacts with the wider socio-technical regime. In order to better understand these interactions I have adapted ideas from boundary management and socio-technical "translations" theories found in SNM.

Projects seldom exist in protective bubbles - free to pursue their own agenda without engaging with anyone else's. Instead, especially in the case of development projects, they have to interact with and negotiate their ways through a variety of different organisations, institutions and the regulatory apparatus of the dominant socio-technical regime. In doing so they will undoubtedly come into contact with ideas, policies and politics incongruent to the objectives of the project, but with which they will never-the-less have to engage in order to implement their project successfully.

Broader stakeholder engagement is not as simple as identifying relevant stakeholders and consulting with them on a particular topic. The 'economics of attention' comes into play in which actors, whether consciously or not, have to allocate their limited time to investigating and engaging with different subject matters (Lanham, 2006). The amount of attention that they spare for any given task is dependent on the task's supposed usefulness with respect to their present situation. Conveying information and soliciting stakeholders' engagement should therefore be done in an efficient manner and in a way that is useful to their work. If this is

achieved the likelihood that actors will devote their attention to a task is increased. Tripp (2009) has applied the concept of economics of attention to plant breeding and crop management arguing that if farmers are involved in technology development, i.e.in participatory plant breeding, their attention should be managed as a scarce resource. By extension, it can also be said that if stakeholders within the public plant breeding socio-technical regime are to be engaged, consideration should be given to manage their attention and involvement in the project. One way to do so is for a project to consciously plan for and implement some form of *boundary management* (Cash et al., 2003).

The term 'boundary' refers to the interface that exists between groups of actors that hold different epistemologies, beliefs, norms and values when they try to communicate knowledge to each other. Boundaries can be found between different communities of scientific experts, decision makers and technology end users (farmers). Boundaries can be problematic to effective communication between disparate groups due to the different ways in which people define what constitutes "reliable evidence, convincing argument, procedural fairness, and appropriate characterization of uncertainty" (Cash et al., 2003:8086). This may have implications for projects that have to translate knowledge into action across epistemological boundaries. Cash and his co-authors suggest that in order to manage the relations between knowledge and action well, efforts need to be applied to plan for effective *communication*, *translation* and *mediation* of information across boundaries (*Ibid*.).

When boundary management is carried out within a project it may provide a means for the project to engage and communicate well with organisations in the broader project implementation context. It is particularly important for projects to identify and characterise the presence of boundaries between organisations that they are working with, in order to find a means to ensure effective channels of communication and learning between themselves. They have argued that If the project consists of a coalition of organisations it is possible for one of them to act as an intermediary boundary organization, responsible for managing and integrating the different types of stakeholder both internal and external to the project (Thuy et al., 2010). The role of an intermediary in spanning boundaries may also be taken up by a stakeholder rather than an organisation. The intermediary should have a good understanding of how both organisations work, access to prominent and influential stakeholders, and knowledge of the differences between the organisations so that the task of knowledge communication, translation and meditation can be undertaken effectively (*Ibid*.).

Within the literature on SNM, boundaries have also been considered with regard to how niches interact with incumbent socio-technical regimes, although this topic remains underdeveloped. Adrian Smith (2007) undertook a review of eco-housing and organic food 'green niches' in the UK in which he investigated how those niches interacted and were interdependent with their respective socio-technical regimes. In particular he considered the "socio-technical translations" aspect of these interactions that occurred between the niches and regimes. In using the term "translation" Smith builds on a concept from actor network theory, in which translation means the transferral of one actor's wilful objectives onto another actor, by considering higher-order translations of socio-technical practices, which he describes as consisting of many smaller individual actor translation events coupled with the reconfiguration of their incumbent networks (*Ibid.*).

Smith (2007) compares and contrasts the socio-technical practices in niches and regimes across the dimensions of guiding principles, technologies, industrial structure, user relations and markets, policy and regulations, knowledge and culture. Through identifying the differences in socio-technical practices between niche and regime he is able to infer potential opportunities for the niche to apply pressure on the regime and the potential barriers it may face in doing so. In recognising the socio-technical departures of the niche from the regime, niche stakeholders may have a greater capacity to apply more targeted boundary management strategies for the communication, translation and mediation of knowledge between the niche and the regime (*Cf.* Cash *et al*. (2003)). This may hypothetically lead to improved communication and cooperation between organisations.

From his work Smith (2007:446) identifies three different kinds of translation, although he states that more may be discovered:

1. **Translating sustainability problems**, i.e. how problems in the regime inform the guiding principles creating the niche.
2. **Translations that adapt lessons**, i.e. reinterpreting elements of socio-technical practice in the niche and inserting them into regime settings, or modifying the niche in light of lessons learnt about the regime.
3. **Translations that alter contexts**, i.e. changes that bring the regime closer to the situation that pertains in the niche, or vice versa.

One of the major similarities regarding both boundary management and the process of fostering socio-technical translations is the need for mediation between the niche and the

regime. Since the niche is often set up from second order evaluation of the normative practices operating within the incumbent socio-technical regime, it follows that translations can flow both ways between the niche and regime. Projects within a niche can evaluate the socio-technical regime to investigate different opportunities for translation and change their approach to institutionalisation accordingly.

This section on learning-based development approaches indicated that there is some conceptual overlap with SNM. The learning approaches as outlined in Romijn *et al*. (2010) consist of points of good planning and management practice that can help organisations and projects manage and develop the niche (internal factors) as well as engaging with and managing its boundaries (external factors).

3.2.4 Power, Space and Time: Further Critiques of SNM

Dr. Romijn and her colleagues are not alone in critiquing strategic niche management and attempting to make it more relevant to a broader range of contexts, such as international development and the Global South. Lawhon and Murphy (2012) have also considered SNM, and in particular the Multi-Level Perspective (MLP), through a political ecology lens. In so doing, they criticise SNM theorists for not considering the issues of 'geography' and 'power' dynamics more centrally in their analyses of socio-technical transitions (*Ibid*.).

In particular, they state that socio-technical transitions theory tends to focus predominantly on the change of 'technological artefacts' and systems of supply as a means to achieve sustainability (Lawhon and Murphy, 2012: 360). They view this as being overly 'teleological' and 'techno-deterministic' – the focus of many analyses within the literature tends to be on the technology rather than its socio-material context (*Ibid*.).

They also draw attention to SNM as incorporating a geographical naiveté that misses important spatial dynamics. This shortcoming is particularly levelled at the MLP, which they say fails to deal with knowledge and socio-technical practice embedded in a variety of space-time contexts beyond the national scale. The three levels of the MLP are also not geographical scales but conceptually related to the 'maturity of the socio-technical system'. Socio-spatial struggles between the niche and regime are not readily apprehensible from the MLP in its current format.

Out of all the criticisms of SNM and socio-technical transitions theory that Lawhon and Murphy (2012) make, the most relevant to this thesis is that SNM and the MLP model does not explicitly consider power relations between the niche and regime, or among their constituent stakeholders. Instead SNM explicitly focuses on 'artefacts', that is to say the technologies, rather than the broad range of actors and their power relationships that contribute to the shaping of niche and regime organisations and praxis (*Ibid.*).

Lawhon and Murphy (2012:362-3) also cite another example of an evasion of power relations in SNM in the way that sustainability transitions are presented. They suggest that SNM does not do enough to unpack the uneven power relations that govern which group of stakeholders' visions for sustainability are operationalised and which are blocked. Moreover, they state, "Socio-technical transition theory and transition management need more careful consideration of how power is mobilized, referenced, and applied to achieve regime shifts, and who are the winners and losers of these processes" (*Ibid.*: 364).

Much like the word 'participation', 'power' is polysemic and, as a concept, may be used in disparate contexts to signify different things. Before proceeding to outline how the concept of power may be used within this thesis, I shall draw on some of the different ways that power has been theorised within the literatures on political economy and ecology, and the differing insights that this has provided.

The concept of 'power' is challenging to define, although most people have an intuitive and intrinsic understanding of it as it relates to the different aspects of their lives. Stephen Lukes (1974, 2005) produced an influential essay that drew upon and added to the work carried out by political theorists in the early 1970s and their forerunners. He proposed that there are three dimensions to the concept of power – a classification that has since gone on to influence sociologists to the present day (*Ibid.*). The *one-dimension view of power* draws on the work of Dahl (1961), who defined a generalised, intuitive account of power as, "*A* has power over *B* to the extent that he can get *B* to do something that *B* would not otherwise do" (Lukes, 1974: 15). Dahl's research followed a 'behaviourist' approach to power, that is to say, Dahl focused on observing the behaviour of groups in a political decision making process. Dahl's analysis inferred that power is a result of conflicts between actors to see who wins and loses, with respect to a number of clearly defined choices, in a relatively open democratic system (Gaventa and Cornwall, 2001:70). If an actor does not participate in the decision making

process, it is assumed that this is due to their apathy or inefficacy, not due to their exclusion from the political process (*Ibid.*). Moreover, this dimension of power supposes a pluralist society in which knowledge and research may be used by actors to influence public debates; with more credible, refined and objective knowledge having a greater power to inform peoples' thinking and decision making (*Ibid*.). Lukes summarises this *one-dimensional view of power* as having a "focus on behaviour in the making of decisions on issues over which there is an observable conflict of (subjective) interests, seen as express policy preferences, revealed by political participation" (1974: 19).

However, the one-dimensional view of power suffers from several limitations. Lukes (1974) proposed a *second-dimension of power* based on the work of the political scientists Bachrach and Baratz (1970) and Schattschneider (1960). In the second-dimension of power, *A* is able to exert power over *B* through altering the decision making process in such a way that only a subset of issues are debated. If *A* is able to control the type of questions asked or knowledge that can be meaningfully used in the debate through an imposition of social and political values and/or institutional practices, then *A*'s set of preferences may be shielded from *B's.* This form of conflict is known as 'mobilisation of bias' – "Some issues are organized into politics while others are organized out" (Schattschneider, 1960: 71).

Lukes (1974) proposed a *third-dimension of power*, conceptually related to the second. In the case of the second-dimension, *A* might exert influence over *B* by controlling a debate or decision making process and the validity of the knowledge used or questions asked; in the *third-dimension,* power and influence may be used to avoid conflict by masking consciousness or awareness of grievances in the first place. This dimension goes beyond behaviourist and pluralist schools, with their emphasis on the observable and the individual, to consider the organisational and systemic effects of power. Lukes (1974:24) describes the *third-dimension of power* as "effective and insidious" since it affects peoples' choices and actions without them being aware of it.

Although Lukes provides a nuanced account of how people may use power in decision making contexts, not all academics agree with his approach. In her book "De-facing Power", Clarissa Haywood (2000: 11) provides an alternative reconceptionalisation of power "as a network of social boundaries that constrain and enable action for all actors", and that 'freedom' or 'power', in this context, is the capacity to act on the social boundaries that constrain and

enable action for all actors. In this theory power is delimited – no longer the possession of individuals or elite groups, instead, it becomes an immanent property of all social actions.

Although Haywood seeks to de-face the power debate established by Lukes and others, these earlier theories of power still have usefulness today, particularly in the context of this thesis and its hybrid conceptual framework. Firstly, the three power dimensions are still found within contemporary development and post-development discourses, especially with respect to the oppression of specific demographics (Gaventa and Cornwall, 2001). This can be seen within the literature on participatory development as the principle of redressing power relations between developers and the developed, which also appears, albeit less explicitly, in the literature on PCI (Chambers, 2008b). Secondly, the three-dimensions of power can be applied to *specific* interactions between *important* individuals or groups within the niche and regime. Focusing on individuals may be useful for constructing a more general understanding of the broader social boundaries that govern action within the niche and regime (*Cf.* Haywood). Finally, Haywood's depersonalised approach to power may also help to transcend the dichotomy of domination and suppression, and in so doing, shine a light on systemic opportunities and constraints for cooperation between niche and regime.

To sum, both SNM and LBDA consist of a number of interrelated concepts that, by themselves, have a limited utility with respect to the topic that this thesis seeks to address due, in part, to the different contexts in which they were developed. In forming a hybrid conceptual framework that utilises ideas and approaches found within both literatures, it is my hope to address any deficiencies in approach that have been highlighted by the likes of Romijn *et al.* and Lawhon and Murphy. In this hybrid conceptual framework, spatio-temporal considerations and power relationships will feature implicitly within the framework and be explicitly discussed within subsequent analysis of the framework.

3.3 Conceptual Framework

The conceptual framework that I adapted in this thesis is a synthesis of ideas stemming from theories found in SNM and LBDA. At the heart of the framework is the MLP, consisting of three entities: the socio-technical niche, regime, and landscape. As discussed above, the regime should exist as a stable configuration of socio-technical practices that govern the actions of stakeholders who work in organisations that are a part of it. In this thesis the regime equates to a public agricultural research and extension system and the socio-technical practices that it entails, with respect to plant breeding in particular. The niche, like the regime, can also be characterised by its socio-technical practices. Its practices are different from those of the regime, since niches are often set up to address perceived deficiencies in the functioning of the regime. Depending on the proclivities of the actors and organisations within the niche, and the voracity with which they critique the regime; the niche may be perceived by regime actors as an aggressive interloper or a moderate reforming influence. In this case, it remains to be seen.

The contrasting socio-technical practices of the niche and regime can lead to tensions between them when they try to interact or work with each other. These potential tensions between the niche and regime will have to be addressed and negotiated in order for there to be any translations or institutionalisation of socio-technical practices between them. Several authors have made attempts to define the socio-technical practices of both niche and regime relevant to their case-studies (Smith, 2007:433, Geels, 2002, Schot, 1998, Rip and Kemp). As the literature on SNM has developed, the socio-technical components of the regime have come to be identified as: science, culture, technology, policy, industry, markets and user preferences (Schot and Geels, 2008). Each socio-technical component is an overlapping optic with which to view the salient features of the niche, regime and their interactions with each other. The list of socio-technical components is necessarily brief given its inclusion in a generalised model of the multi-level perspective in SNM (*Ibid.*:546). However, in order for it to be usefully applied to the subject matter of this thesis, these terms need to be revised and expanded upon.

My conceptual framework is based around the following socio-technical considerations:

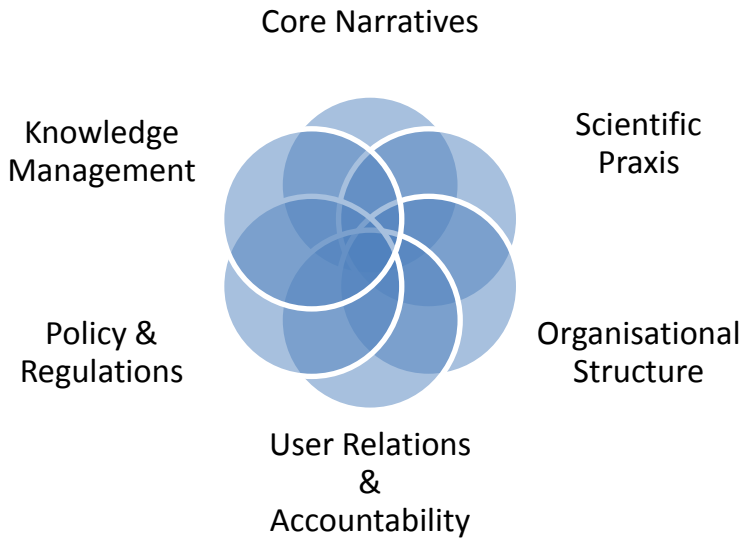
- **'Core Narratives'** – these are the guiding principles and rationales that actors within an organisation adapt to describe and justify their work to themselves and to others.

- **'Scientific Praxis'** – the term 'praxis' I take to mean, 'the practical application of theory'. Scientific praxis here refers to the selection, codification, and practical application of scientific theories within organisations and institutions. In this thesis it principally refers to the ways in which the crop improvement process is carried out, from plant breeding research to the extension of new varieties, and the justification of these activities through scientific concepts and other narratives.
- **'Organisational Structure'** – refers to the management and organisational framework within which the various activities of an organisation take place. In this thesis I consider the broader institutional structures in which specific organisations are embedded, as well as the structures of the relevant organisations themselves. The structure of organisations and their management, while set up for one purpose, can result in institutional inertia and technological path dependencies when an organisation is challenged with reform.
- **'User Relations & Accountability'** – refers to the relationships that technology developers have with the intended beneficiaries of their technologies. Traditionally in SNM the term 'markets' is adjoined to user relations rather than 'accountability'. I have chosen to substitute 'markets' for 'accountability' since development projects and public sector plant breeding organisations are not directly held to account by market forces, unlike other industries. Instead non-market driven 'accountability' is split between funding agencies and end-users (farmers); although the strength and balance of this dynamic is itself variable.
- **'Policy & Regulations'** – 'Policy' refers to inter and intra-organisational derived dictates that impose a new form of structure or activity on an organisation. Policies can range from being merely intentional statements to moderate or severe reforms, but it is the process of translation and application that changes them from the realm of intension into something more tangible. 'Regulations' consist of the rules that govern the creation, testing and dissemination of technologies, and also their use. Regulations may also codify standards of practice and interactions between different stakeholders.
- **'Knowledge Management'** – refers to the knowledge base of the niche and the regime and how it is managed. In particular this lens is used to consider what knowledge is sought after by different organisations; their capacity to learn; the degree to which different types and sources of knowledge are privileged over others; and the relative ease that knowledge can flow between stakeholders in that organisation.

These six socio-technical considerations form broad lenses with which to more closely investigate both the niche and regime. The differences that occur between them will help highlight potential opportunities and constraints to socio-technical translations between them. However, labelled and listed in the manner above it might be thought that each category is demarcated and hence exists independent of the other socio-technical dimensions. Each dimension consists of dynamic and static elements that collectively characterise the regime or niche, and elements of one dimension may feature prominently in others – much like a Venn diagram (see Figure 3).

The concerns of LBDA, as generalised by Romijn *et al.* (2010) in their synthesis of LBDA with SNM approaches, can also be found in the guise of the socio-technical dimensions listed above. Their representation of core LBDA theoretical considerations consisted of the following factors: project design and management practices; the management culture of the project implementing organisation; leadership characteristics of key stakeholders and managers; principles of participation; and the broader project implementation context (*Ibid.*). Referring back to Table 5, one of the major points of departure between LBDA and SNM is that the unit of analysis of the former is the project whereas the latter is the niche. PCI has largely been experimented on within various development projects; it may therefore be useful to extend and modify the examples of good practice derived from SNM with those from LBDA.

Figure 3 - Socio-technical Dimensions for Contrasting Niche and Regime Processes



Source: *Author*

Adapted from: *Smith (2007); Schot and Geels (2008)*

Table 6 consists of an extension of the redefined socio-technical dimensions listed in Figure 3 to include best practice 'probes' to consider when investigating the socio-technical aspects of the niche and regime. The different socio-technical dimensions will be used to investigate the structure of both the niche and regime showing the similarities and differences between them. This will in turn highlight some of the barriers and opportunities to greater farmer participatory research or client-orientation in crop improvement research. Furthermore, it will aid me in assessing the project determined successes and potential for scaling-up and institutionalising PCI in its current project oriented format, as well as what might be changed in order to create more lasting translations between the niche and regime.

Table 6 - Socio-Technical Dimensions including Examples of 'Best Practice' Derived from SNM and LBDA

Socio-technical Dimensions	Probes	
	Niche	**Regime**
Core Narratives	Identification of core narratives that underlie project, PCI programme and regime practices. Further identify perceptions of stakeholders with respect to farmers, scientists, donors and other related NGOs.	Identification of core narratives that underlie research and extension activities of regime. Source regime stakeholders' narratives on 'participatory research'.
Scientific Praxis	Project design: planning and technology choice and justification; relations to previous projects; resource mobilisation; incentive creation; capability building; and planning for expansion and diversification. Management practices: intra and inter-organisational learning and knowledge management. Methods & Evaluation and determining of project 'successes'.	Determine: • Activities of crop improvement and extension. • Relationship of crop improvement activities to other socio-technical dimensions. • Freedom to pursue alternative formats of crop improvement
Organisational Structure	Identification of: • Stakeholders and organisational hierarchy in research network. • Temporal evolution of research network (niche) and how it relates to different projects.	Identification of: • Key stakeholders and organisational hierarchy in organisation/regime. • Position of organisation in relation to other organisations in regime.
User Relations & Accountability	Principle of Participation: role and degree of inclusion of stakeholders endogenous and exogenous to the project within its activities. Accountability: to whom; degree; and impact of accountability on project practices.	Principle of participation: role of farmers in research and extension system. Receptivity to working with other partners. Accountability: to whom; degree; and impact of accountability on project practices.
Policy & Regulations	How policies and regulations impact on socio-technical dimensions of the niche.	(As for the niche)
Knowledge Management	Knowledge management: effective strategies; short lines of communication; minimal bureaucracy. Boundary management: protocols; intermediaries. Learning: type of learning (1st order/2nd order/reflexive) Leadership responsibilities/style of key stakeholders	Knowledge management: effective strategies, short lines of communication, minimal bureaucracy. Learning: type of learning (1st order/2nd order/reflexive) Leadership responsibilities/style of key stakeholders

Source: Author

I will further investigate the notion of socio-technical translations through considering the information derived from analysing the case-study by way of the socio-technical dimensions listed in Table 6. In this endeavour the general findings of Smith (2007:444), as summarised in Table 7, will provide a useful basis with which to challenge the findings of the PCI case study with a view to looking for different types of niche-regime 'translation'.

Table 7 - Summary of Socio-technical Translation Issues as Applied to SNM Case studies

Analytical Focus	**Socio-technical translations**
Learning	
• 1st order lessons about socio-technical performance	Some niche practices are sufficiently flexible to be interpreted favourably against regime socio-technical criteria. This permits those practices to translate into regime settings.
• 2nd order lessons reflecting upon framing assumptions	Niches informed by sustainability problems in the regime. System-building pragmatists can help translations.
Institutional Embedding	
• Technical configurations	Practices that can be added onto regime configurations, or slot in easily, are favoured, i.e. articulated with existing regime.
• Niche expectations	Lack of deeper institutional embedding can fragment expectations amongst niche actors.
• Social-network formation	Tense relation between niche initiating idealists and pragmatic system builders. Regime adaptation permits wider practice of aspects of niche, but at cost of original vision.
Regime Tensions	
• How pressures are articulated	Niches seek to represent regime tensions to their own advantage. Different tensions – beyond niche control – provide occasions for diverse actors to (re)interpret the niche favourably
Niche-Regime Linkages	
• Translating sustainability problems	Niches and regimes develop different kinds of sustainabilities through both positive, synthetic interactions, and through contention, antithetical interaction.
• Adapting lessons	Niche lessons are interpreted from regime perspective and adapted accordingly.
• Altering contexts	Niche-regime engagement can lead to mutual adaptations, though regime more influential.

Source: Smith (2007:444)

3.4 Research Questions

Core research question (CRQ):

What are the critical institutional and policy factors that govern the continued co-existence and contestation of participatory crop improvement initiatives with the formal crop improvement regime, and that have prevented these participatory crop improvement approaches from being scaled-up and institutionalized?

Sub-research questions (SRQs):

1. What are the core socio-technical practices which characterise the Indian public plant breeding regime, and how do they govern the ways in which plant breeders carry out their research?
2. How did the PCI aspect of WIRFP manage its interactions with the plant breeding socio-technical regime and other PCI projects and organizations?
3. Have there been any lasting socio-technical translations between the PCI niche and plant breeding regime, and what are the implications of this for other PCI projects and programmes?

3.5 Research Design

3.5.1 Research Strategy: The Case Study

This thesis uses a case study approach to address the issue of PCI institutionalisation through the attempted application of an SNM conceptual model. In this next section I will begin with a justification for the use of a case study methodology to investigate niche-regime interactions. This will be followed by a broad description of the case study area and some of the important PCI projects that have occurred there. Finally I will further explain the reasons for choosing and defining the case study as it is and clarify its bounds.

3.5.2 Justification for a 'Case Study' Research Strategy

The SNM conceptual framework, research questions and context of PCI research necessitates the use of a case study methodology in order to investigate the niche, regime and niche-

regime interactions that may or may not result in some form of institutional translation between them. In Robert Yin's seminal work (2003:13) he defines the case study as, "...an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between the phenomenon and context are not clearly evident." The concepts of niche and regime, when overlaid onto a collection of PCI projects (niche) and a national agricultural research and extension system (NARS) (regime), invariably describe complex systems whose interactions are necessarily context dependent.

Yin (2003:9) describes the case study as an advantageous research strategy to use when employed in a scenario in which the research questions are of an explanatory nature ('how' and 'why' types); which concerns a contemporary event; and which does not require control of behavioural events. Moreover, he states that the case study copes with situations "in which there will be many more variables of interest than data points"; where there will be "multiple sources of evidence with data needing to converge in a triangulating fashion"; and, in which there "has been prior development of theoretical propositions to guide data collection and analysis (Yin, 2003:13)". All of these situations are applicable to the research context of this thesis.

Case studies, like other research strategies, can be broadly classified as *exploratory*, *explanatory*, or *descriptive* in their scope (Berg, 2000:229, Yin, 2003:3). Other general types of case study include those which are *intrinsic* (research undertaken in depth for a particular interest), *instrumental* (research undertaken to pursue an external generalised interest or inform theory) or *collective* (research undertaken involving multiple instrumental cases) (Stake, 2005). These classifications are not necessarily mutually exclusive but may overlap so that, for instance, a case study may both be *intrinsic* and *instrumental* in nature reflecting the multiple interests of the researcher (*Ibid.*:445). The number of different types of case studies suggests that this methodological approach can be employed for a number of reasons under differing scenarios. However their design, implementation and analysis will impact upon the reliability and generalisability of inferences made from the collected data.

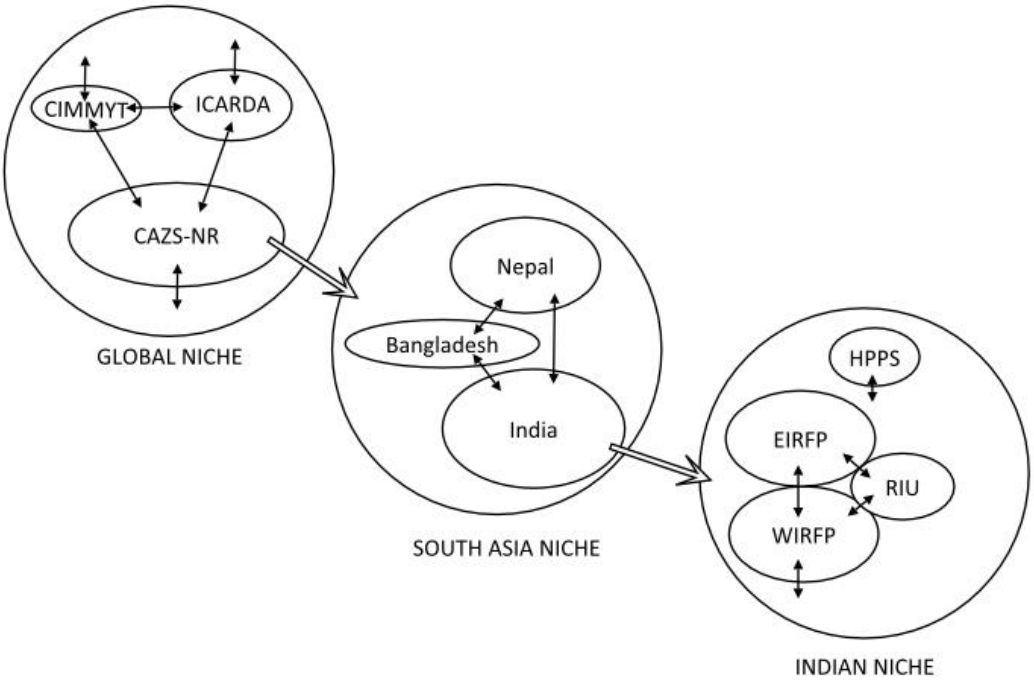
An important methodological consideration in the design and implementation of a case study is the selection of an appropriate *unit of analysis* and *boundaries* to the case study. Within SNM studies there are three units of analysis, the niche, the regime and the interactions that occur across the boundary that divides them (Smith, 2005:132). Niches are considered 'strategic' if they meet the following criteria (Kemp et al., 1998:186, Smith, 2005):

- They articulate new ways of using novel technologies.
- They generate lessons about the feasibility of these new configurations.
- They have the potential for further development and improvement.
- They involve a constituency of different actors who support the significant changes articulated by the niche.

In using a case study research strategy with SNM it is important to identify the strategic niche, its context and the case study boundaries. Smith's definitions of a 'strategic niche', implies that these criteria may be applicable to the idea of a PCI niche (*Ibid*.). As part of the literature review I have considered the evolution of PCI methodologies and some of the research groups that have developed them. The interactions of these researchers at conferences, symposia, through their academic publications and through more informal channels constitute a global PCI niche. Through experimenting with and using PCI methods in different projects and programmes around the world they have iteratively adapted and developed these methodologies. However, when it comes to PCI institutionalisation, these projects and programmes often operate in and across distinct geographical locales and with different organisations.

The case study employed in this thesis concerns the PCI work funded by DFID and carried out by CAZS-NR and its research partners in South Asia (*Cf*. Conroy (2009a)). I have chosen a case study consisting of a single longitudinal time-bound case covering two phases of a large development project, the Western India Rain-fed Farming Project (WIRFP), and its subsequent alteration and extension under DFID's Research Into Use (RIU) Programme. Figure 4 illustrates the nesting of the Indian PCI niche within a South Asian and Global PCI niche.

Figure 4 - Selecting the Level of PCI Niche



Source: *Author*

Key: *Different potential bounding of PCI niches according to global, regional and country level grouping of PCI projects.*

As explained in the literature review and corroborated by Walker (2008), there have only been two global research groups that have consistently carried out and developed large-scale PPB programmes in particular geographical locales for a sustained period of time – the DFID-CAZS-NR partnership and the ICARDA Barley Programme, although other PCI projects have been carried out by other CGIAR centres such as CIMMYT. The sustained pursuit of these programmes, in terms of their locations and research activities, axiomatically suggests they may be suitable niche candidates for further investigation since they are more likely to have formed linkages with the public plant breeding system/NARS. Moreover, the longevity and scale of those PCI programmes further suggest that they are the best candidates out of all PCI projects for investigating possible niche-regime translations.

I chose to focus on the CAZS-NR niche, rather than the ICARDA programme, because the CAZS-NR niche consists of a large research network that has carried out PCI independently and as part of larger development projects; it has worked on a larger number of crop species; and operated over a longer period of time. The three main countries in which CAZS-NR has carried

out PCI projects are Bangladesh, India and Nepal, with most of the work having been carried out with project partners in India and Nepal (Figure 4).

Although the unit of analysis is the CAZS-NR niche, the sheer amount of research carried out by this institute and its research partners over 20 years is staggering and must be addressed to select a feasible location to carry out fieldwork. Opting for a single longitudinal case study of a prominent longstanding project within this niche may capture not only how PCI methodologies have been developed and used, but also the socio-technical research practices of the Indian NARS, and the interactions that occurred between this niche and regime.

Yin (2003:39) cites five circumstances under which a single case design may justifiably be used: if it is a critical case, extreme or unique case, representative or typical case, revelatory case, and/or longitudinal case (*Ibid.*). The rationale behind choosing the WIRFP as a case study is that it lends itself to a *longitudinal* (temporal) analysis and that it is both *unique* and *typical* depending on the framing. It is rare (unique) because there have not been many long term PCI projects that have operated in a particular area for approximately 20 years; and it is typical because the methodologies that it uses and the ways in which they are applied are generally representative of projects across the global niche[13]. It is of note that although there is some flexibility in how PCI methods can be used; there are constituent features that need to be present in order for the activity to meet the definition of PCI, PPB/COB, and PVS and CAZS-NR satisfies these criteria (*Cf.* Witcombe and Yadavendra (2006).

The second unit of analysis is the socio-technical regime. PCI is an umbrella term that covers research activities, such as PPB/COB, as well as those which overlap with extension activities, such as PVS. It is therefore important to consider both research and extension activities in the context of analysing a crop improvement technical regime. Many NARS and public plant breeding systems treat research and extension as dichotomous activities that are often carried out by separate departments. Any account of public plant breeding organisations as a socio-technical regime should also consider the relationships between plant breeders and extension staff.

[13] A summary of the methods used during WIRFP can be found in Witcombe and Yadavendra (2006). Each PCI project is unique, however, the WIRFP may have similarities to, and be representative of, other PCI projects that are funded on a project basis by aid or governmental agencies and collaborate with public-sector research organisations. *Cf.* Weltzien *et al*. (2003: 125-205) for an inventory of PCI projects that have collaborated with formal crop improvement sector around the world.

As a second unit of analysis the 'socio-technical regime' needs to be considered and chosen carefully as it is has the propensity to be context laden. In order for any claims to be made regarding the institutionalisation of PCI, both embedded units of analysis should be investigated with respect to their representativeness of other types of niche and regime. The Indian NARS is certainly unique; however it shares similarities to other NARS seen in other countries. In his NARS typology, Jain (1989) lists three broad NARS systems managed by different apex-level bodies: agricultural research councils (ARC); national research institutes (NRI); and, ministry of agriculture models. He further elaborates this broad system-level classification by also considering the different types and ways in which research stations are organised (*Ibid.*). The Indian NARS is headed by the Indian Council for Agricultural Research (ICAR). The Agricultural Research Council model is used by a range of different countries and can be further differentiated into 'managing' and 'coordinating' councils (Senanayake, 1990). ICAR is described as *the* "prototype of the council model" and, as such, is a model that has and continues to influence the NARS of neighbouring south Asian countries and those further afield (*Ibid.*:12).

Previously India was one of the countries at the centre of the Green Revolution (GR). Today India is a global player influencing future agricultural research trajectories, as well as a battleground for a number of pivotal debates surrounding diverse issues such as food security, biotechnology, environmental degradation, and farmer democracy movements, among others (Scoones, 2006: *passim*). There has also been a clarion call within the country for greater investment and a renaissance in agricultural research to address the shortcomings of the original GR, and launch a second GR, which some stakeholders have termed an 'Evergreen Revolution' (Scoones, 2006, Swaminathan, 2010). Some neighbouring countries such as Nepal and Bangladesh, as well as those with similar agricultural and socio-economic mores, continue to look to the India for guidance and inspiration on how to structure their own agricultural research systems (Senanayake, 1990). This has resulted in some aspects of the Indian NARS appearing to differing degrees in other countries' agricultural research and extension systems. Out of the three South Asian countries that CAZS-NR has predominantly worked with, it seems prudent to focus on India in light of the degree of influence it exerts over its neighbouring countries.

With respect to the question of whether the Indian NARS is representative of other NARS regimes, it is useful to consider the similarity and differences of *processes* that occur within the regime. Although the consideration of types of NARS structures has some merit as a

classification exercise, an investigation into organisational processes and praxes can go beyond a more general classification of organisational type. The relevance of processes, activities and relationships is that they may appear across different NARS independent of their structural type. Any conclusions that may result from this study will acknowledge the degree to which they are context dependent or have potential to be more generalisable.

The next section will provide a broad overview of the case study area and key projects before elaborating on why this case has been selected and how it is bounded.

3.5.3 An Introduction to the Case Study Area

As discussed in the literature review, PCI methods have been experimented with and shown to provide potential research efficiency and farmer empowerment benefits; however their uptake by public agricultural research bodies and NARS has been less than anticipated by PCI advocates. Where the decentralised barley breeding programme has been partially institutionalised within ICARDA and the countries in which it has been implemented, the work carried out by CAZS-NR on highly-client orientated plant breeding has not enjoyed similar impacts, particularly in India, although it has fared better in Nepal (Ceccarelli and Grando, 2007, Sharma et al., 2006). Despite initially promising in-roads into public agricultural and development policy arenas made by the NGOs and researchers involved in developing COB, these successes have not been sustained when project funding has been removed. Of all the work done on COB in Bangladesh, India and Nepal, this has especially been the case in India (Conroy, 2009b).

The Western India Rain-fed Farming Project (WIRFP) is situated in a geographical locale in which there are multiple co-existent plant breeding systems that include projects affiliated with the state and federal governments, state agricultural universities (SAUs), NGOs, international development agencies and private companies. The climate of the project area is sub-tropical characterised by hot dry summers. Significant areas of these states feature semi-arid agricultural land, and it is the varietal requirements of resource poor farmers from tribal communities in these areas that the PCI projects in this region have sought to address. These crop improvement projects varied in terms of the degree of participation and client-orientation in which they engaged.

The WIRFP and Eastern India Rain-fed Farming Project originally arose out of an earlier project called the KRIBHCO Indo-British Rain-fed Farming Project (KRIBP). KRIBP, much like its successors the WIRFP and EIRFP, had Western and Eastern operational domains. The KRIBP project was a bilateral development project jointly funded by the British and Indian Governments (Jones et al., 1996). KRIBP (West) began in 1992 and operated across a contiguous region of three States: Madhya Pradesh (MP), Gujarat and Rajasthan (*Ibid.*). A central tenet of the KRIBP approach was that of participatory research and technology development (*Ibid*.). As part of the project a team of expatriate consultants were constituted to design and carry out research, and guide project interventions through applying their various areas of expertise. One of these consultants was Dr. John Witcombe, a former ICRISAT plant breeder, who went on to implement, experiment with and develop PCI methodologies throughout South Asia. The first phase of the WIRFP (KRIBP) was focused on generating an understanding of the natural resource management and livelihoods needs of the people in the project area. This phase was characterised by the use of participatory rural appraisals (PRAs) and the trialling of different livelihood interventions. The second phase was an expansion of the scope of the first, with an emphasis on the promotion of sustainable livelihoods, farming system development, participatory technology development, and its dissemination. The main implementing agency for KRIBP and WIRFP was initially Krishak Bharati Cooperative Limited (KRIBHCO), a fertiliser co-operative, before it eventually formed a separate NGO called the Gramin Vikas Trust (GVT) which would independently manage and run the projects.

Over the course of the first and second phases of the WIRFP project Witcombe and CAZS-NR would also become the manager of the Plant Sciences Research Programme (PSP), part of DFID's Renewable Natural Resources Research Strategy (RNRRS), which operated 1995-2005. The PSP would act as a research 'institute without walls' commissioning its own research as well as accepting competitive tenders for research funding (Stirling et al., 2006). A key aspect of the PSP mandate was that it carried out 'demand-led' research. Since PCI is demand-led and DFID was already carrying out PCI research as part of ongoing development projects, further PCI projects were funded in areas where DFID already had a presence, i.e. India, Bangladesh and Nepal. The PSP projects that operated in India worked closely with the research network that had already been established through bilateral aid projects such as the WIRFP, although they were also autonomous to the extent that they could address research issues that were not within the mandate of these progenitor development projects. Research could therefore be targeted to address knowledge gaps and related concerns that had arisen from the development of PCI methods in earlier projects such as KRIBP and WIRFP.

On the completion of WIRFP phase II in 2006 DFID funded the continuation of the PCI work albeit in a massively reduced capacity under the Research Into Use (RIU) Best Bets Programme. This new project however focused on scaling-up seed production of the varieties previously identified and developed through PVS and COB methods. It also sought to set up community seed organisations to continue this work with the hope that this would sustain the benefits of the PCI-derived varieties by maintaining their seeds that would otherwise no longer be produced.

Other than the rain-fed farming and RIU projects the PCI approach, specifically PVS, has spread and been used by a number of NGO partners in other rural development projects. Two projects were particularly noteworthy with respect to the degree that PVS has been carried out within them. These projects are the World Bank's District Poverty Initiatives Programme (DPIP) and DFID's Madhya Pradesh Rural Livelihood Project (MPRLP).

3.5.4 Selection Rationale and Bounding of the Case

This section seeks to expand upon the rationale for selecting this case over other potential cases, before defining the boundaries of the case. Previously Section 3.5.3 briefly outlined some of the key projects and events of the WIRFP project and other projects that have operated in a similar geographical locale that both directly and indirectly involve PCI methods.

This case study is a single longitudinal case with three embedded units of analysis – the socio-technical regime, the niche and the interactions that occur between them. The broad rationale for choosing the work of CAZS-NR, and the Indian niche in particular, has been presented earlier in Section 3.5.2. As highlighted in the previous section, there have been a number of PCI projects that have followed on from or run in parallel to each other across the same broad location. The decision to choose which projects would make up the case was influenced by their relative usefulness weighed against the feasibility of travelling to them. I decided to not consider the EIRFP directly as an area that I would visit for fieldwork. Although COB was carried out in EIRFP, the breeding focus was on rice and it resulted in the release of one variety, Ashoka 200F, across a number of states (Conroy, 2009b). I assumed that it would be better to focus on the WIRFP rather than the EIRFP since seven varieties have been created using COB methods as part of WIRFP and the number of SAUs that were partners were four

rather than one (*Ibid.*). The area that WIRFP covers is smaller than both project areas combined and therefore represents a more manageable study area with a higher concentration of research partners and activities (*Ibid.*).

The decision to follow the development of a project from its inception to its progeny and spinoffs represented an opportunity to examine how over time the PCI research activities evolved, engaged with the formal/public plant breeding sector, framed success and failure, and been interpreted by the funding agency. Temporality is an important aspect in understanding niche development and the evolution of PCI thought and practices in the regime. Following a project chronologically makes it possible to trace how different events effected the development of the project and its potential for institutionalisation.

The bounding of the case study in a longitudinal manner considering first the KRIBP, WIRFP and then RIU projects allows for a logistically feasible fieldwork area as the location remained consistent. There were a number of significant events that may be relevant to PCI institutionalisation and niche development but which occur outside of the fieldwork area, in the Indian, South Asian or global niches. There were also other events outside of the case study timeframe that have impacted on and helped determine current organisational structures or praxes in the niche and regime. In establishing a timeline these extra-locational and temporal events can be sampled and woven into it as appropriate. Many of these events will concern projects or decisions made as part of them and will have been recorded in different project documentation, and as such, will be able to be listed. Their inclusion in the thesis depends on their appropriateness and usefulness in highlighting aspects of the niche and regimes operation. Their sampling and subsequent inclusion will be of a purposive nature but I will list the sample of projects that I have considered.

3.5.5 Operationalising the Conceptual Framework

At its heart the conceptual framework presents a way by which the niche and regime can be studied and characterised in terms of the following socio-technical dimensions: core narratives; scientific praxis; organisational structure; user relations & accountability; policy & regulations; and knowledge management. As discussed in the socio-technical framework, these ‘dimensions’ have derived from the theories and experiential analyses of authors publishing in the LBDA and SNM literatures regarding what they consider to be key issues in

promoting institutionalisation of technologies and practices within organisations. Once characterised, the socio-technical similarities and differences between the niche and the regime can be further examined in order to better understand the practicalities of institutionalising the different aspects of niche praxis within the regime. Furthermore the differences and similarities between the various socio-technical dimensions can be compared with the interactions that have occurred between the niche and regime to collectively target the core research question (CRQ) (See Section 3.4).

Each sub-research question (SRQ) focuses on a different aspect of the CRQ. The first SRQ concerns the characterisation of the plant breeding regime in terms of its socio-technical practices or dimensions. The second SRQ concerns the socio-technical practices of the key projects of the case study, namely the WIRFP, and how it operated as a niche and interacted with the public plant breeding system. The third SRQ is concerned with whether there have been any lasting socio-technical translations between the regime and niche and whether there are any generalisable lessons from the experiences of the niche for the stakeholders involved.

3.6 Data Sources and Collection Methods

In the previous section I outlined the case for pursuing a longitudinal case-study of the WIRFP and its associated projects as well as the Indian public plant breeding system; and through considering them conceptually as a niche and regime, investigate the relationships between them. In this section I will outline the types of data that I intended to collect and how I went about collecting it. Finally, I will consider the problems and limitations that I encountered in implementing the methodology.

The data collected for the case study stems from a number of different sources:

- A review of pertinent literature
- Documentation (policy documents, working papers and project technical reports)
- Semi-structured interviews

Yin (2003:97) recommends the collection of multiple sources of evidence to develop "converging lines of inquiry". Triangulating the sources of data to corroborate a constructed fact can address issues of construct validity because the same finding across several sources

provides multiple measures of the same phenomenon (George and Bennett, 2005, Yin, 2003). In the following sections I will discuss these sources of data in more detail.

Over the course of the research I undertook two periods of fieldwork in India. The first period took place 30th March 2010 – 22nd August 2010 and consisted of preliminary fieldwork, language training and improving my understanding of the Indian public plant breeding sector and project field areas. The second or main fieldwork phase took place between 7th December 2010 and 21st May 2011.

During the first period of preliminary fieldwork I spent some time in Hyderabad with the Centre for Research on Innovation and Science Policy (CRISP), who were responsible for evaluating RIU's projects in South Asia at the time. While in Hyderabad I visited a number of NGOs; the Directorate of Rice Research (DRR), responsible for coordinating rice research across India; and the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT), an international CGIAR research centre. After Hyderabad I visited the broad project area of the WIRFP and the SAUs in this area including Anand Agricultural University (AAU) in Gujarat, and some staff and field offices of GVT including three villages that had participated in the WIRFP. I also visited the offices of the MPDPIP and MPRLP in MP after learning that they had used PVS methods as part of their programmes. This initial visit to India helped me contextualise a lot of the secondary data on the PCI projects and public plant breeding that I had only read about previously. From this initial experience I iteratively altered my conceptual framework and fieldwork plans prior to returning to India.

When I returned to India for the second phase of fieldwork I had devised a threefold strategy with which to build on the information collected from the preliminary visit:

1. Implement a comparative stakeholder attitudinal and research system analyses of the Indian public plant breeding socio-technical regime.
2. Further investigate the role of the Gramin Vikas Trust (GVT) as the main implementing agency of WIRFP, and any other organisations that had been exposed to PCI as a result of the WIRFP.
3. Exploratory research with organisations that were interested in agricultural research policy, farmer participation in research, and the farmer democracy movement.

The aim of the first part of the strategy was to provide in-depth information for addressing SRQ1. I planned to visit each of the major SAUs that the WIRFP had collaborated with in the

project area. The objective of this part of the strategy was to uncover information on the socio-technical dimensions that define normative plant breeding in the case study area. It would also provide information on the framings of plant breeders who acted as consultants for the COB project regarding the methodology itself; the COB WIRFP and how it was implemented; and the opportunities and limitations for employing COB in their research.

The second part of the strategy was to investigate the role of GVT in the COB WIRFP and the way in which it implemented the project. This also involved following-up on points-of-interest that arose during the preliminary fieldwork phase regarding the use of PVS by other NGOs and development projects that had been exposed to PCI methodologies as a result of interactions with GVT, WIRFP and CAZS-NR.

The third part of the strategy, consisting of exploratory research, was more general in scope and involved following-up leads that arose from interviewing people over the course of phase one and two, as well as from my own internet research. I carried out exploratory research as I travelled through the states of MP, Gujarat, and Rajasthan; as well as in the cities of Hyderabad and New Delhi. As the capital, Delhi was the headquarters for many government bureaucracies and NGOs. The aim of the exploratory research was to provide a broader context for the issues of farmer participation and democracy; poverty and development interventions; and agricultural research, in light of agricultural research in India. I anticipated that these leads would reveal potential tensions between the state and central government agricultural research and extension regimes. It would also provide an opportunity to investigate the driving narratives of key organizations and institutions regarding research priorities and policy making.

On returning to the UK I visited Prof. Witcombe at CAZS-NR in Bangor, Wales. CAZS-NR was the lead organization in developing the COB methodology so staff at the research institute would be able to provide much insight into the socio-technical practices of the niche as well as their struggles to get PCI methodologies mainstreamed. Witcombe provided his entire cache of aide memoires from the WIRFP and EIRFP phase I and phase II projects. This has been incredibly useful in better understanding the functioning of the niche projects, their interaction with their SAU partners, and triangulating the data I recorded from interviews in India.

The following sections address each of the data collection methods used, namely: the collection of literature, documents and interviews.

3.6.1 Literature Reviews

Academic literature has been used in a number of ways in this thesis: in the beginning to orient myself to a particular topic, and then periodically throughout the different phases of the thesis in order to keep abreast of any developments in areas of interest. I have used a number of search engines including Web of Science, Web of Knowledge and Google Scholar to perform comprehensive internet searches using a number of keyword parameters depending on the topic. The purpose of these searches varied from finding initial information on a topic and furthering my knowledge of an issue, to corroborating and triangulating findings from the primary data collected in the field.

The first literature review I carried out concerned understanding the fields of farmer participatory research (FPR), plant breeding, and more specifically, participatory plant breeding and the Indian NARS. As part of this review I undertook to systematically identify the major stakeholders and groups who had carried out FPR and PPB; the development of PPB and FPR methodologies; the problems that had been encountered in the process; the successes generated; as well as their current statues. Much of this information is reviewed and recorded in the Literature Review. Journals that have regularly published work on PCI include *Euphytica* and *Experimental Agriculture*; the latter containing much of the peer-reviewed papers produced by CAZS-NR. Other websites that have been useful with respect to project reports and non-peer reviewed working papers include the CAZS-NR website, which retains much of the research institute's final technical reports from the PSP; the Institute for Development Studies (IDS) and STEPS Centre working paper series; DFID's Research for Development (R4D) portal, containing information on research funded by DFID; and, RIU's website, listing its current activities and the theory and motivation for the programme. Insights from these literatures were helpful formulating my understanding of the major accomplishments of PCI, the narratives used to support and justify them, and the narratives which inform normative research and extension in India.

Another literature review was carried out on topics that were of interest in the conceptual framework as well as the methodology sections, including: SNM, LBDA, organisational

management, and case study methodology. I found the work of the following authors regarding SNM and sustainable transitions to be particularly illuminating - Adrian Smith and Frank Geels who are based at SPRU, University of Sussex, as well as that of Henny Romijn and Rob Raven, based at the Department of Innovation Studies, Eindhoven University of Technology, The Netherlands.

3.6.2 Documentation

Documentation relating to PCI projects and the Indian NARS are important sources of information, and the analysis of their contents can aid in the characterisation of the different socio-technical dimensions of niche and regime. Documentation produced by the niche and regime can provide insight into how the activities of the niche and regime are monitored and evaluated and how success is characterised by the organisations and stakeholders involved (Sumberg et al., 2012b). Organisational documentation not only records how organisations wish to project themselves to external parties, some of whom they may be accountable to; but also how organisations shore up and rationalise the narratives which they use to justify their activities to themselves. The analysis of project documentation can also provide insight into the activities carried out by organisations that may be too technical or complex in nature to accurately or sufficiently convey during interviews.

Aside from the electronic documentation collected as part of the literature reviews, I undertook to collect as much electronic and paper documentation as possible from the stakeholders I visited and interviewed during my fieldwork. A record of these reports can be found in Appendix 1. The availability of documentation and a person's willingness to share it varied among stakeholders and organisations. The general method I used for sourcing and obtaining documentation was to ask whether any documentation was available that would help me better understand the activities of the organisation prior to arranging interviews. Then, during the interviews or after them as appropriate, I would reiterate my request for any relevant project documentation – altering my request to account for any new areas of interest that would naturally arise over the course of the interview process.

Documentation collected as part of my interaction with public plant breeding institutions helped me to better understand how seed management and varietal testing activities were theoretically carried out. I also gained some insight into research objectives and technological

outputs produced, as well as the various means of testing and making farmers aware of this information. With respect to those the PCI projects which collectively make up the niche, I was able to view the final technical reports produced for DFID as well as a number of third party consultant reports on the outcomes of the projects and the PCI approach. The information recorded in these documents helped develop hypotheses to be tested during interviews and was useful to triangulate with the data collected during the fieldwork.

3.6.3 Interviews

3.6.3.1 Semi-Structured Interviews

The main source of primary data came from semi-structured interviews carried out with various stakeholders in the niche and the regime. Semi-structured interviews are a type of interview in which the interviewee is asked a set of questions based around a series of topics in order to guide the interview process, but which allows the interviewer to adapt to new threads of information introduced by the interviewee. This approach differs from structured interviews or questionnaires which instead dictate a more precise wording and order to the questions. The semi-structured approach to interviewing provides a greater degree of flexibility and more space for the articulation of stakeholder narratives and the elaboration of salient points of interest as and when they arise. The higher degree of flexibility in the semi-structured approach to interviews is appropriate in that it allows for the interview to adapt to the heterogeneity in the breadth and depth of interviewee knowledge on a given topic. Furthermore flexibility and adaptability of approach is important in engaging with those stakeholders who are reticent; who try to impose their will on the structure and flow of the interview; or in dealing with the arising of unforeseen time constraints and interruptions to the interview process.

I used semi-structured interviews for interviewing stakeholders in both the regime and the niche. Rather than adopt a random sampling strategy I chose a purposive one since there was only a small population of actors that I could interview, and it was not my intention to make statistically generalisable inferences from this population. Inferences that result from interview data are necessarily context-laden, depending on the conditions that make up the interviewee's circumstance. Instead I adopted an elite interviewing strategy through which I aimed to interview the key stakeholders who acted as gatekeepers with respect to the flow of knowledge and decision making within their respective projects and organisations. In order to

help identify the key stakeholders I also used a chain-referral sampling strategy whereby I asked stakeholders whether they knew of anyone else who was important within the process or organisation in question they felt I should interview. This strategy was useful for identifying 'invisible' stakeholders as well as those whose importance was not readily apparent to me (Tansey, 2007). Using elite stakeholders in interviews has also been cited as a useful means of corroborating and triangulating what has been established from other sources, such as in reports and published literature, as well being of benefit in helping to reconstruct the decisions and actions which lay behind a series of events, such as those which established the PCI niche projects (*Ibid.*).

Regarding the Indian public plant breeding regime, I employed what turned out to be an overly ambitious interview structure on account of the large amount of information that I was trying to collect on all the different socio-technical dimensions. I decided to interview plant breeders and staff at the State Agricultural Universities (SAUs) listed in Table 8. The names of plant breeders who had worked with GVT on COB projects were provided to me on consultation with Dr. Yadavendra.

Table 8 - SAUs at which COB Plant Breeders were Located

University	**Main Campus**	**COB Plant breeder**	**Location of plant breeder**
Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (**RVSKVV**)	Gwalior, MP	Dr. M. Billore	Indore Campus
Anand Agricultural University **(AAU**)	Anand, Gujarat	Dr. A.M. Mehta Dr. S.M. Khanorkar	Anand Campus Anand Campus
Sardarkrushinagar Dantiwada Agricultural University **(SDAU)**	Palanpur, Gujarat	Dr. S.B.S. Tikka	Sardarkrushinagar Campus
Maharana Pratap University of Agriculture and Technology (**MPUAT**)	Udaipur, Rajasthan	Dr. Ameta Dr. D.P. Saini Dr. Rajesh Pandya	Banswara Research Station Banswara Research Station Banswara Research Station

The approach that I adopted to interviewing different plant breeders was to acquire as much information as possible from documents on the socio-technical dimensions which characterised their plant breeding practices, and solicit their opinions on the potential merits of greater farmer participation in research. The interview was structured so that I could make a cross-sectional attitudinal comparison on the perception of FPR between plant breeders who had been exposed to PCI and those who had not been. A general structure of the plant breeder interview schedule can be found at Appendix 2.

A combination of factors led to me being unable to complete this attitudinal comparison among plant breeders, including: underestimating the number of plant breeders at each research station; trouble gaining access to some institutions; the length of time required to carry out the interview; a lack of time resulting from staff having to work on their own activities and deadlines; staff being absent from the research station or SAU. In spite of these issues, the information collected from the interviews was sufficient to provide insight into a number of important factors which characterise the public plant breeding regime.

Alongside interviewing the plant breeders who had worked with PCI methodologies, and those who had not, there were a number of other organisations and stakeholders that I aimed to interview in order to build a more rounded picture of the Indian NARS. Although I spent time at each of the three major SAUs – AAU, MPUAT and RVSKVV, I also visited a number of peripheral research stations and Krishi Vigyan Kendra (KVKs), when opportunities arose. At these centres I interviewed personnel who were involved in both the fields of research *and* extension to better understand the entire process of crop improvement – from developing, to testing, release, multiplication of seed and eventual distribution to farmers. I also tried to interview staff from the State Department's of Agriculture (DoA) in Rajasthan, Gujarat and MP, although gaining access to these organisations proved problematic. In turning my attention to the federal system of crop improvement research, I interviewed personnel at the Directorates of Rice Research (DRR), Maize Research (DMR), and Soybean Research (DSR). I also interviewed the Assistant Director General (ADG) for Seeds at ICAR Headquarters, New Delhi.

Regarding the activities of the Niche, I interviewed the former and current project managers of GVTs western project areas. I also interviewed GVTs crop consultant for the West, Dr. Yadavendra, and another member of staff who had worked closely with Dr. Witcombe throughout the initial KRIBP and WIRFP projects. I also interviewed staff at the NGO, Action for Social Advancement (ASA) and staff at the MPDPIP and MPRLP, where PVS activities had been carried out by ASA and GVT on several occasions.

A detailed list of interviews carried out is provided in Appendix 3.

3.6.3.2 Unstructured Interviews

In the process of interviewing stakeholders there were occurrences when the interviewee could not or was not willing to answer questions; would only carry out an interview in a group setting; or could not complete the full interview due to another commitment or time constraints. In these instances I would try to complete the semi-structured interview as best as possible, but would use my discretion with respect to opening up the interview in order to capture the thoughts of the interviewee(s) on topics that they thought merited discussion regarding the interview. In so doing I could at least be assured that the dominant perspectives of the interviewee were recorded since there was no guarantee that I would be able to reschedule the interview for a later date in light of the logistics and time constraints imposed by travelling to different organisations.

Unstructured interviews were also used to discuss broader topics and narratives such as farmer participation in research; the goals of Indian agricultural research; poverty and rural development; with stakeholders who were not or had not been directly engaged with the case study projects. The views elicited from these persons on these topics helped inform and develop my understanding of these issues, and were useful in the iterative refinement of the questions and probes used in the semi-structured interviews.

3.7 Ethical Considerations

Research ethics and issues pertaining to the confidentiality of information resulting from interviews and documentation was a central concern during the fieldwork process. Prior to carrying out interviews with stakeholders I had to negotiate access to a number of organisations – particularly in the Indian NARS. Negotiating access to research organisations was sometimes done on my behalf and facilitated by Dr. J. P. Yadavendra. In both cases the nature of my research was made explicitly clear prior to interviews, via correspondence, and at the start of each interview by citing my core research question and briefly explaining it. A reference letter from the university was also attached to each email requesting access to an organisation, and a hardcopy was offered to any interviewee to look over at the start of the interview. Negotiating access was problematic on a number of occasions prior to and during fieldwork trips. This prompted me to revaluate the processes by which I made contact and

negotiated access to organisations, helped in part by the examples of 'best practice' outlined by Feldman *et al*. (2003).

At the start of each interview, interviewees were asked whether I could record the interview and were told that if so, they could speak off the record at any time. They were also offered the opportunity to remain anonymous should they choose. The issue of anonymity was particularly important in situations where the interviewee was part of a hegemonic hierarchy, or when asked to comment on a aspect of practice, project or organisation that they might deem sensitive.

3.8 Funding

The research was funded entirely through a 3 year Economic and Social Research Council (ESRC) scholarship. The scholarship included a living allowance for the duration of the doctoral programme, and provided additional funding for difficult language training and overseas fieldwork. The funding for difficult language training provided me the opportunity to travel to India, learn some hindi to help me negotiate travel through the Indian countryside and carry out essential preliminary fieldwork to help better inform and pilot the case study. The dates of the trips to India have been mentioned above.

4 Indian Public Plant Breeding as a Socio-Technical Regime

4.1 Introduction

"History Matters"

Historical economists and sociologists have presented several different theories related to just how history can matter in relation to the formation and continuation of different institutions (Liebowitz and Margolis, 1995, Mahoney, 2000, Barnes et al., 2004). It may appear self-evident that 'history matters' with regard to the structure and functioning of contemporary organisations and institutions. However, tracing the historical *path dependence* of current organisations and institutions can provide insights into the stability and resistance of its constituent socio-technical elements to change.

An organisation's resistance to new ideas and processes can be called 'behavioural lock-in', in which previous decisions, research trajectories and organisational structures (path dependency) determine the current ones, even if alternative products and/or processes are superior (Barnes et al., 2004). McGuire (2008) has provided an account of path dependency in Ethiopian plant breeding and how it has limited participatory reform.

This chapter looks at the historical evolution of the Indian National Agricultural Research & Extension System (NARS) from its origins to the present day; how this in turn conditions the structures and practices which govern its activities; and how collectively these phenomena provide opportunities for and block the adoption of alternative research narratives, such as PCI. To this end, this chapter is structured so that the general-aspects of the Indian NARS such as its history, organisational structure and policy design and implementation are discussed first, before focusing in on the praxis and specificities of public plant breeding.

By first providing an overview of its historic origins, I trace the evolution of crop improvement and plant breeding research and extension from its inception to the present day. I describe and analyse the organisational and hierarchical structures of the Indian NARS and how this conditioned, facilitated and constrained much of the plant breeding research. This section principally characterises the Indian public plant breeding regime in terms of the socio-technical

factors of its 'organisational structure'. Next I consider the issues of policy and regulation at the State and Federal levels and reflect on how new policy has historically altered the scientific praxis of plant breeding and its associated organisational structure. In this section I predominantly consider the Indian NARS in terms of both its 'policy & regulations' and the 'core narratives' which support it. Next I consider the process of crop improvement from plant breeding to extension of the finished varieties. I will consider the degree of client-orientation and farmer accountability that is already present; how new varieties are tested and legitimised through the varietal release system; and the nature of research and extension linkages. I will show through this and subsequent chapters that the general research and extension process greatly limits the way in which outside organisations can cooperatively work on research projects. Furthermore I will demonstrate the historical and current tenuous nature of research and extension linkages and the poor accountability of the system to farmers, and how this impedes any efforts for internal reform. Finally, I consider the methods of greater client orientation in plant breeding and what institutionalisation might mean in light of the various constraints imposed by organisational structure and established policy and practices.

4.2 Evolution of Public Plant Breeding in India

An historical account of the evolution of the Indian NARS is central to understanding its current structure and operation. There are a number of informative reviews on the development of the Indian NARS in the academic literature (*Cf.* Pal and Singh (1997); Mruthyunjaya and Ranjitha (1998); Pal and Byerlee (2006); and Glendenning *et al*. (2010), *inter alia)*. The following history of the Indian NARS will focus on the broad periods and general events which are of particular salience in characterising the current state and structure of the regime.

4.2.1 History of the Indian NARS

The origin of the Indian National Agricultural Research and Extension System (NARS) is rooted deep within India's colonial history. Many of the organisations that persist today, such as the Indian Agricultural Research Institute (IARI) and the Indian Council of Agricultural Research (ICAR), stem from organisations that were founded prior to independence. Central government agricultural research and extension (R&E) originally came under the aegis of the Department of Revenue, Agriculture and Commerce, established in 1871 (Pal and Singh, 1997). The staffing levels within the Department were subsequently expanded on the basis of

recommendations found in the 1880 Famine Commission Report (*Ibid*.). In 1905, IARI was established along with six other agricultural colleges in important provinces and collectively charged with teaching and research responsibilities. 1921 saw the establishment of the ICAR on the recommendations of the Royal Commission of Agriculture (1926). ICAR was set-up to be an autonomous body in order to govern and promote agricultural research nationally. Both IARI and ICAR substituted the word 'Imperial' within their titles for 'Indian' on independence in 1947 (*Ibid.*).

4.2.1.1 Research System

Around the time that ICAR was founded a number of central commodity committees were constituted by the Indian government that predominantly focused on research for commercial and export crops (Pal and Singh, 1997). The committees were semi-autonomous bodies, with respect to ICAR, who received money from GoI grants and through local taxes. Their mandate was to promote commodity development and research and they were made up of various stakeholders from agricultural departments, trade and industry and producers themselves. The commodity committees tended to focus on the crops they were responsible for limiting the amount of cooperation between different committees on cross-commodity research topics such as nutrient, soil and pest management (*Ibid*.). Pal and Singh (1997) state that post-Independence a gradual momentum arose within ICAR and the agricultural research community to address the limitations of the commodity approach and carry out research on a "cross-commodity basis". Another narrative that gained traction within the research system at the same time was the need to carry out "regional research" – that is produce research that acknowledged the differences between agro-ecologies and the differing research requirements of farmers in them. In 1957, with technical support from the Rockefeller Foundation, the first All-India Coordinated Project on maize was started (Singh et al., 1995: 12, Pal and Singh, 1997). This was the start of research that ignored state political boundaries and focused on different agro-climatic zones (ACZs). Subsequently other projects dealing with different commodities were incorporated into this new programme by the central government heralding the birth of All-India Coordinated Research Projects (AICRPs).

In 1963 The MoA commissioned an Agricultural Research Review Team headed by Dr. Marion Parker of the United States Department of Agriculture to review the organisation of agricultural research in India (Borthakur and Singh, 2012). The following year the Indo-American team submitted their report which recommended the reorganisation of ICAR (*Ibid*.).

In 1965 the previous semi-autonomous commodity committees were abolished and control over them was ceded to ICAR from the Central Department of Agriculture and Food. This led to ICAR becoming the apex body for agricultural research with greater control over the planning and implementation of research programmes (Pal and Singh, 1997). Moreover, the position of director-general of the ICAR changed from an administrative to a scientific post with the promotion of B. P. Pal, one of the architects of the Green Revolution (Borthakur and Singh, 2012)[14]. In 1973 the GoI and MoA created the Department of Agricultural Research and Education (DARE) to establish and coordinate research linkages between the Central and State governments as well as the international CG research centres and other NARS.

In 1949 the findings of the University Education Commission were that there was a need to establish rural (agricultural) universities in the states. Prior to this there was virtually no coordination between agricultural and veterinary colleges. Furthermore, although there were some agricultural colleges operating under the different state Departments of Agriculture they were severely hindered by administrative and financial constraints. In 1950 and 1960, two joint Indo-American teams came together and endorsed the establishment of State Agricultural Universities (SAUs). The SAUs were set up along the lines of the land-grant American universities, and part of these joint Indo-American teams included members from American land-grant universities and the US Agency for International Development (USAID). The first SAU under this initiative was created in 1960 at Pantnagar, in Uttar Pradesh. SAUs were given autonomous status to pursue their own research agendas and were funded by the state governments[15]. In return they provided education on agriculture, as well as carrying out their own agricultural R&E (Pal and Singh, 1997).

Following the implementation of findings/recommendations of the Education Commission (1964-66), which was set up to address to improve education post-Independence, and the Review Committee on Agricultural Universities (1977/78), the functions of SAUs were standardised and all agricultural research in the states came under their aegis (Pal and Singh, 1997). In 1979 the SAU's capacity to carry out research under different agro-climatic zones (ACZs) was further enhanced when they acquired regional research stations as part of the

[14] At around this time an eminent scientist, M. S. Swaminathan, became the head of IARI. He would later become the champion of the 'Evergreen Revolution' narrative that is sometimes referred to in contemporary Indian agricultural policy debates.

[15] SAUs exhibit more or less autonomy from ICAR according to the proportion of their R&E budgets which is funded by ICAR. This means that although they are free to pursue their own research agendas *in principle*, ICAR still wields influence over what should be researched through the research agenda of its AICRP programmes.

World Bank sponsored National Agricultural Research Project (NARP) (*Ibid.*). Pal and Suresh (1997:15) state that "Addressing zonal research needs and fostering linkages between research, extension and farmers were the main responsibilities of these research stations."

4.2.1.2 *Extension System*

So far I have discussed the evolution of the Indian NARS specifically focusing on the aspect of research. With respect to agriculture, research is usually considered in conjunction with the word 'extension', as opposed to 'development', which is found in other more industrial research contexts. Extension is the counterpart to research – knowledge, technologies and products derived from scientific and engineering research are made available and *extended* to farmers in rural locales. The system of agricultural extension in India has arisen in an *ad hoc* manner from policy created to address the pressing concerns of a moment, in a way not that dissimilar to the evolution of the agricultural research system.

The origin of agricultural extension in India began with the formation of the Department of Agriculture (DoA) in 1881 and its continued development up till the time of independence when the DoA became the Ministry of Agriculture (Pal and Singh, 1997). During this period (1881-1947) agricultural extension was one of the activities of the Department, however no directed effort was made to speed up and improve the efficiency of transferring technology to farmers (*Ibid*.). At around the same time some isolated efforts were made to start rural development programmes, including the improvement of agriculture (Prasad, 1989). However, DoA considered that these sporadic and *ad hoc* programmes might not be able to sustain their activities with farmers, and so a nationwide, multipurpose extension network was envisaged to deliver agricultural extension activities on a continual basis (Pal and Singh, 1997).

In 1952 the Government of India (GoI) implemented that vision by starting 55 Community Development Projects in selected areas nationally (Pal and Singh, 1997). At the lowest level each worker would cover 10 villages. For each project, there was a team of different extension officers who were specialists in different fields such as: agriculture, animal husbandry, cooperation, village industries and rural engineering. The philosophy behind the projects was one of 'integrated rural development' in which extension officers from different specialities worked together to provide solutions to agricultural problems. In 1953 the National Extension Service (NES) Programme was launched and was organised along the same lines as the Community Development Projects, but with less resource intensity. The architects of the NES

programme argued that the programme would build on the success of the earlier development projects but scaled-up to cover the entire country by 1960/61 with the majority of funding put forward by the GOI. The aim of NES was to accelerate the pace of rural development, including increased employment and production, through the application of scientific methods to agriculture. A strong focus of the programme was on peoples' participation and self-help (Pal and Singh, 1997).

Pal and Singh (1997) also explain that,

> "Front-line extension work ... was initiated as (the) agricultural research system grew in the ICAR and SAUs. A department or directorate extension was established in the ICAR institutes and SAUs. The basic objective of these departments was to conduct extension research, demonstrate latest technologies, provide feedback to scientists, and provide training support to State Department of Agriculture."

Providing feedback on the efficacy and appropriateness of new technologies from farmers to scientists was supposed to be an integral function of the extension system. However, the broad rationale for carrying out PCI was based on the assumption that this function is deficient, not structured or even absent from many extension systems.

Other developments in extension philosophy and its application occurred after the 1960s. ICAR introduced a number of large-scale front-line extension programmes including the National Demonstration Project (NDP) (1965), Operational Research Project (1972) and Lab-to-Land Project (1979), *inter alia*. As implied by their names, the predominant focus of these programmes has been one of transfer of technology from the "Lab-to-Land". The role of the farmers in these projects was that of recipients of scientific technical products and knowledge directed at improving the productivity of their land (Kumar and Shivay, 2008:177). Mantras embodying this transfer of technology approach, such as 'Lab-to-Land' and 'seeing is believing', persist to this day within public research and extension circles as enduring sound bites from the ideological narratives underpinning past projects (*Cf.* Ayyapan (1999:32) and (Ahmed et al., 2007)[16].

Between 1964 and 1966 the Kothari Education Commission recommended the establishment of agricultural polytechnics to provide vocational education and training in agricultural subjects

[16] This is something that I personally have experienced when visiting Crop Directorates and speaking with research and extension staff at each SAU.

to rural persons (Ayyappan, 1999). ICAR constituted a committee chaired by Dr. Mohan Singh Mehta[17] in order to address the Education Commission's recommendations (Ayyappan, 1999: 34). In 1973 the committee formulated the institutional design of *Krishi Vigyan Kendras* (KVKs), or Farm Science Centres, based on three principles:

1. "The *Kendra* will impart learning through work-experience and hence will be concerned with technical literacy, the acquisition of which does not necessarily require the ability to read and write.
2. The *Kendra* will impart training only to those extension workers who are employed and to the practising farmers and fishermen. In other words, the *Kendra* will cater to the needs of those who are already employed or those who wish to be self-employed.
3. There will be no uniform syllabus for the *Kendras*. The syllabus and programme of each Kendra will be flexible in nature and tailored according to the felt needs, natural resources and potential for agricultural growth in that particular area." (ICAR, 2011)

In 1974 the first KVK was founded in Pondicherry on a pilot basis and was deemed a success by ICAR. Under each Five Year Plan the GoI's Planning Commission has made funds available for the establishment of further KVKs (ICAR, 2011). In a 2005 speech the Indian Prime Minister planned for there to be a KVK in each rural district by 2007; as of 2011 there were 589 KVKs across the country (*Ibid*.). The XIth Plan has made preparations for there to be two KVKs in the larger rural districts potentially raising the number to 667 (*Ibid*.). It is obvious from the amount of funds that were made available for the establishment of KVKs, and the number that have been built, that the KVKs represent a central and cherished part of the Indian extension system.

In 1974 a new agricultural extension philosophy called the 'Training and Visit' (T&V) system took root in India, sponsored and funded by the World Bank (Moore, 1984). The new T&V system dwarfed any of the extension initiatives that had come before. Prior to T&V, agricultural extension activities were predominantly the preserve of the *Panchayati Raj* (local elective government) Department(s) whose duties included assigning agricultural extension activities to Village Level Workers (*Gram Sevak*). The Village Extension Workers (VEW) often had little agricultural training and extension work represented only part of their responsibilities (*Ibid.)*. At this time the MOA did have its own field workers, however, they

[17] Dr. Mehta was the head of *Seva Mandir* (Lit. 'Temple of Service') a grassroots NGO working on natural resource development and sustainability. He was previously a former education minister, Prime Minister of Banswara, and Vice Chancellor of Rajasthan University in the former State of Mewar (now Rajasthan) prior to independence.

were limited to working on special crop programmes and mainly concentrated on input supply; moreover, they only operated within the 28 out of India's 400 districts taking part in the MoA's Intensive Agricultural Districts Programme (*Ibid*.).

The T&V system, also known as the 'Benor system' after its originator, sort to reform agricultural extension in India in a number of different ways, involving both institutional and organisational structural changes as well as those directed at the roles and duties of extension workers (Benor et al., 1984: passim). Firstly, the T&V model envisioned a 'unified extension service' controlled by the MoA rather than the *Panchayati Raj* Line Department. It sought to redefine the role of the extension worker by removing their auxiliary responsibilities (input/credit supply etc.) so that they could be free to exclusively pursue extension activities – principally the transfer of technology from research station to farmers (*Ibid*.).

Each VEW would become responsible for all extension activities concerning all crops in their mandated area thereby removing the redundant parallel activities of different crop-specific programmes and agencies (Benor et al., 1984). In turn the VEWs were supposed to receive support and regular, intensive training in relevant agricultural knowledge, practices and technologies. T&V mandated the imposition of an extension hierarchy populated by different grades of staff that were responsible for specific activities within the extension system. The lowest level extension workers were the VEWs whose duties were to visit and train farmers. They did this by working within an area of jurisdiction, termed a 'circle', in which they would identify eight areas and within those areas a number of 'contact farmers' with whom they would meet on a regular fortnightly basis. The purpose of the contact farmers was to convey the extension messages to other farmers in their area who were unable to attend the meetings. A group of approximately eight VEWs were managed by an Agricultural Extension Officer (AEO) whose purpose was to assist in organisational management of the VEWs and see that their extension needs are met. Much like VEWs, AEOs predominantly work in the field. VEWs and AEOs periodically meet with Subject Matter Specialists (SMS) every fortnight to receive relevant training and to discuss their experiences with farmers in the intervening periods. Above the AEOs resides the Subdivisional Extension Officer (SDEO) whose responsibility it is to coordinate trainings for VEWs and AEOs while also carrying out field visits and ensuring that the extension material is relevant to his geographical domain. Above the SDEO are District levels, governed by District Extension Officers (DEOs), who are in turn nested below Zonal Extension Officers (ZEOs), all the way up to Headquarters staff who reside in the MoA (Benor et al., 1984, Moore, 1984). Along with the new hierarchical organisational

structure and roles for extension staff, the T&V model explicitly states that the technologies and knowledge demonstrated to farmers should be appropriate to their needs and be as cost effective as possible (*Ibid.*). Benor also made specific reference to the importance of research and extension linkages and viewed T&V as a means to improving them through the deliberate and regular meeting of researchers with extension staff.

India was a crucible in which T&V was tried, tested and later rolled out. In 1974, T&V was trialled in the Chambal Command Area in Rajasthan and Madhya Pradesh (Moore, 1984). At this time the 'Command Areas' were regions that were serviced by large-scale irrigation schemes with the aim of being high-potential agricultural production regions. The initial trial project was deemed a success and was extended to other States in India through three phases of World Bank-assisted National Agricultural Extension Projects (NAEPs) (Glendenning and Babu, 2011)[18]. The series of three NAEP projects were co-funded by the World Bank and the GoI (*Ibid*.). In 1995 at the end of NAEP-III the World Bank stopped it's funding of the T&V system in India, which in turn led to a decline in T&V activities as individual states were unable to sustain the previous level of funding (*Ibid.*).

Critics such as Moore (1984) cite T&V's high running costs and dependency on World Bank funding as one of the major reasons for the failure of the system to sustain itself. This was further compounded by a lack of adherence to T&V principles by many extension staff (*Ibid*.). Part of the reason for this was that the T&V model tried to roll-out a blue print plan that did not take into account the underlying institutional foundations on which it was being erected, as well as the heterogeneity of different agro-ecological and socio-economic contexts which make up much of India (*Ibid.*). Moreover, despite its ostensible policy on delivering *appropriate* extension messages relevant to the different types of farmers and their farming conditions, the separation of input supply from the activities of extension meant that, in the absence of an extensive and pervasive input system, the usefulness of the extension advise given to farmers remained moot (Anderson et al., 2006).

Regardless of the conflicting accounts of the impact of T&V in terms of the suitability of its goals and methods or its return on investment to the World Bank and Indian Government, much of the organisational structures and extension staff positions/roles that were put in place under T&V still persist to this day, albeit in a reduced capacity which varies between

[18] NAEP-I in Madhya Pradesh, Rajasthan, and Orissa; NAEP-II in Haryana, Karnataka, Jammu and Kashmir, and Gujarat; and NAEP-III in Uttar Pradesh, Assam, Himachal Pradesh, and Bihar.

states (Moore, 1984, Anderson, 2007). In the time following the end of T&V, funding was greatly reduced and the public extension system stagnated, although the lack of a single bureaucratic and mandated approach allowed for some experimentation in different states to emerge (Sulaiman and Holt, 2002: 23).

One of the major new initiatives developed after T&V was the founding of the Agricultural Technology Management Agency (ATMA). ATMA is another World Bank supported programme that was initially piloted in 28 districts in seven states across India between 1999 and 2003 originating as the Innovations in Technology Dissemination component of the National Agricultural Technology Project (NATP) (Glendenning and Babu, 2011)[19]. After its pilot phase, ATMA was scaled-up and implemented nationally across all states, although in only about a third of the districts in India (the actual number of districts in India continues to rise year on year). According to Glendenning and Babu (2011: 13), "ATMA is an attempt to increase the organizational performance of public-sector agricultural extension in India, which traditionally works through top-down, linear methods, by reorienting the process to be decentralized, integrated, demand-driven, and participatory from the district level". These principles which underline the aim of ATMA, arose largely is response to critiques on T&V, both by staff at the World Bank and those in the Indian Department of Extension (*Cf*. (Birner and Anderson, 2007, Directorate of Extension, 2000)).

The ATMA extension model works alongside other extension elements and is implemented by each state as it sees fit. The purpose of ATMA is to act as a bridge across different line departments (i.e. agriculture and rural development), integrating and improving R&E and extension and farmer linkages and decentralising decision making through establishing a bottom-up planning process (Singh et al., 2006). As part of the ATMA process a Strategic Research and Extension Plan (SREP) is formulated by ATMA-linked extension staff for each district using Participatory Rural Appraisal (PRA) methods. Each SREP identifies high-value crops, market value chains, and innovations from progressive farmers, sampled from within the district, which are then condensed to form the R&E priorities for the district. In 2010 the Department of Agriculture and Cooperation (DAC) released revised guidelines for ATMA which altered its structure and improved the financial support it receives (Glendenning and Babu, 2011). Prior to the revised guidelines, states were required to implement ATMA without the

[19] Glendenning and Babu (2011) provide an in-depth review paper of ATMA and its origins and structure, and provide a focused assessment on its capacity to effect organisational change within the Indian public extension system.

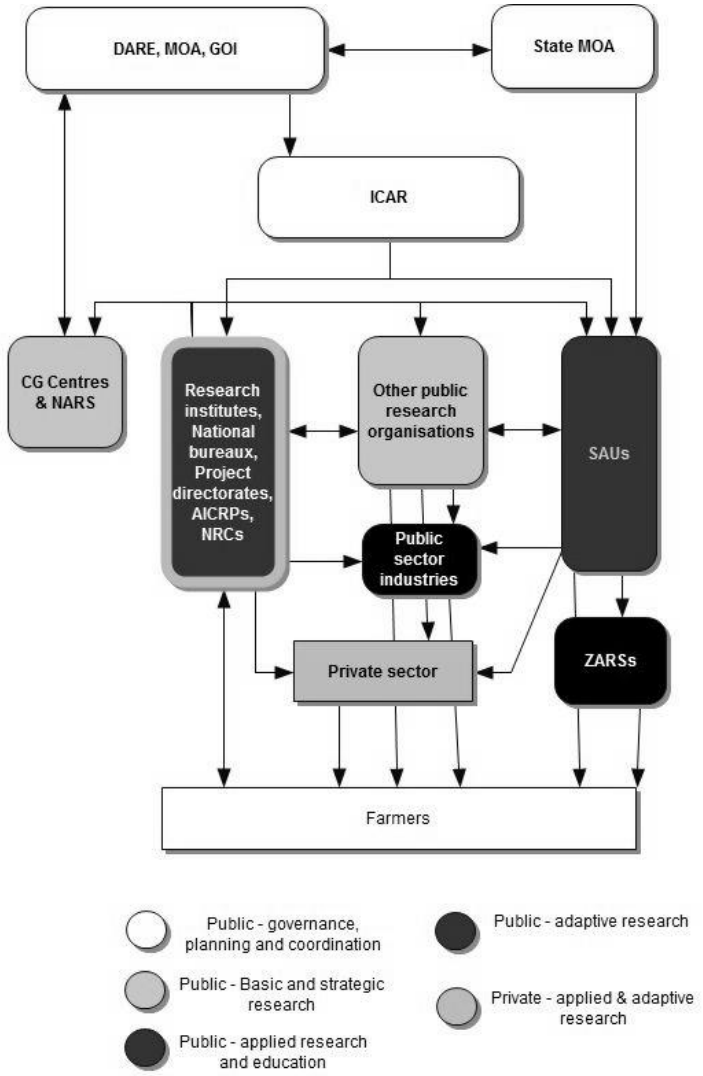
extra provisions in terms of funding and personnel made available for the project when it was in its pilot phase. The ATMA model represents a promising model for fostering better research, extension, farmer and market linkages, though its strengths and limitations will be discussed later in Chapter 7 when I discuss the potential for institutionalisation of PCI methods.

4.2.2 Current Organisational Structure

The account of the evolution of the Indian NARS has outlined many of the organisations which make up the system. Although agriculture and its policy is the preserve of individual states, the central government exerts considerable control over research agendas and extension initiatives, not least because of the money it contributes to the cash-strapped states through centrally-run schemes. Figure 5 (below) illustrates the institutional structure of the Indian NARES according to Pal and Singh (1997). The arrows represent the directionality of *potential* research linkages between the different organisations. The reality is that research links between organisations vary in their strength according to the project being considered.

Figure 5 shows that there are three types of organisation which are involved in the governance, coordination and planning of agricultural research in India. ICAR is the apex body responsible for promoting, coordinating and undertaking agricultural research throughout India. ICAR itself is managed via a number of bodies which provide direction on everything from policy, to technical, administrative and financial matters. The major bodies are the: General Body, Governing Body, Standing Finance Committee, Norms and Accreditation Committee, 24 Scientific Panels, and eight Regional Committees (8) (*Cf*. Balaguru (2012: 5-7) for more details). The Governing Body consists of eminent scientists, academics, legislators and farmers' representatives and is the chief executive and agricultural policy making authority within ICAR and is also responsible for the functioning of ICAR itself (*Ibid.*).

Figure 5 - Institutional structure of the Indian agricultural research and education system



Source: *(Pal and Singh, 1997)*

As mentioned previously, ICAR is linked to the Central and State Departments/Ministries of Agriculture through the agency of DARE. The Director General of ICAR, who is always a scientist who has risen through the NARS, also acts as the Secretary (head) of DARE. Meetings between senior officers from ICAR and the Department of Agriculture and Cooperation (DAC) are held biannually to discuss issues of national importance related to agricultural research and development issues. Although DARE acts as a coordinating body, SAUs can form direct linkages with other NARS and international research centres without going through ICAR or DARE. Any links to the private sector are also made directly between those organisations, i.e.

between a SAU and private company – existing legislation allows for these interactions (*Cf.* Singh *et al*. (1995) for more information).

The work carried out by ICAR is subdivided into a number of subject matter specialities managed on a divisional basis: crop science, horticulture, natural resource management, agricultural engineering, animal science, fisheries, agricultural education, agricultural extension, knowledge management, administration and finance (Pal and Singh, 1997). Each division is headed by a Deputy Director General (DDG), under which are a number of Assistant Director Generals (ADGs). The scientific panels have a broad tripartite role – they advise ICAR on technical issues related to their speciality; they scrutinise project funding applications for their appropriateness and feasibility; and alert ICAR to any deficiencies in research and extension within their field. Each scientific panel consists of approximately 20 experts chosen from a number of organisations across the country.

Table 9 - Regions for ICAR-State Coordination in Research and Development

Region	States Covered
I	Himachal Pradesh, Jammu &Kashmir, hills of Uttar Pradesh
II	Assam, West Bengal
III	Sikkim, Mizoram, Arunachal Pradesh, Nagaland, Meghalaya, Tripura, Manipur, Andaman & Nicobar islands
IV	Bihar, Punjab, plains of Uttar Pradesh, Delhi
V	Orissa, Andhra Pradesh, east Madhya Pradesh
VI	Haryana, Rajasthan, Gujarat, UTs: Dadra & Nagar Haveli, Daman & Diu
VII	Maharashtra, west and central Madhya Pradesh, Goa
VIII	Kerala, Karnataka, Tamil Nadu, Pondicherry, Lakshadweep islands

Source: (Pal and Singh, 1997)

Since 1975 research linkages between ICAR and the States have been strengthened through the formation of eight regional committees each consisting of a number of different States (See Table 9). The purpose of the regional committees is to assess the agricultural problems of the region and direct research and extension activities towards addressing them. The regional committees are made up of range of actors including officials of high-standing from ICAR and its subsidiary organisations which may include everyone from the Director General, Deputy Director Generals to the Heads of relevant institutes and concerned scientists. Other members

include representatives from the Departments of Agriculture and relevant line departments of the region's States, Vice-Chancellors of the SAUs, other scientists and representatives of farmers' and NGO groups. The regional committees meet every two years and are therefore able to only set a broad agenda for each zone. The membership of panels and committees such as the regional committees can allow for the spread of ideas through the cross-nomination of members in a number of different positions and contexts. High-level representation of scientists and politicians on the regional committees creates the potential for elite capture where less-privileged persons are less likely to have floor time and be listened too. Members of these panels, committees and working/steering groups can effect major changes in policy, particularly when involved in producing reports for the Planning Commission.

In Table 10 Pal and Singh (1997) show the breakdown of the Indian NARS according to the types of research that different organisations are responsible for. There are four National Research Institutes that can be thought of as premier, national research universities each with a different remit and responsibilities for carrying out basic and strategic research within their respective fields[20]. Other organisations are tasked with different functions and work under different modes of research. In the literature review, I explained that PCI is concerned with addressing the needs of particular demographics of farmers, often resource-poor subsistence farmers, their agro-ecologies, their production constraints, and the markets which they serve. Therefore PCI practitioners are engaged in forms of applied and adaptive research. It follows that should a PCI project wish to engage with the public research system, it would appropriately do so at a level and with organisations that are similarly engaged in applied and adaptive research in the region in which they are. With respect to the Indian research system these organisations are the SAUs and the Zonal Research Stations that they manage.

[20] The four National Research Institutes are: the Indian Agricultural Research Institute (IARI), National Dairy Research Institute (NDRI), Indian Veterinary Research Institute (IVRI) and Central Institute of Fisheries Education (CIFE).

Table 10 - Major Activities of the ICAR and SAU Research System

Institution	Number (1996/97)	Number (2012)*	Main Activities
National research institute	4	4	Basic and strategic research of national importance, education, man-power training
Central research institute	41	48	Commodity/resource specific basic and strategic research with divisional set-up, education
National bureaux	4	6	Conservation and exchange of germplasm, soil survey
AICRP directorates	10	12	To fill research gaps in the All-India Coordinated Research Projects not met by the SAUs; and research coordination
National research centres	30	17	Commodity/resource/discipline based strategic research in mission mode
All India coordinated research projects	86	62	Coordination of commodity/resource specific research in different zones of the country
Agricultural Universities			
Central University (IARI)	1	1	Applied research and education for north eastern states
SAUs	28	51/61	Applied research for the state and education
Zonal research stations	120	-	Adaptive research for the zone

Source: (Pal and Singh, 1997)
* 2012 data from (DAC, 2012), but no data known for zonal research stations

Each SAU carries out crop improvement research for specific problems within the area of the State for which it is responsible. At the start of the KRIBP in 1993, each involved State was serviced by one SAU responsible for all agricultural research within its boundaries[21]. Each of the three states has over the course of the project split their SAUs, making them responsible for smaller areas of the State[22]. SAUs are governed by a board of management and an

[21] Rajasthan Agricultural University (RAU), Rajasthan; Gujarat Agricultural University (GAU), Gujarat; and Jawaharlal Nehru Krishi Vishwavidyalaya (JNKVV), Madhya Pradesh.

[22] RAU was split into three universities in 1999 becoming: Swami Keshwanand Rajasthan Agricultural University, Bikaner; Rajasthan University of Veterinary & Animal Sciences, Bijay Bhavan Palace Complex, Bikaner; and, Maharana Pratap University of Agriculture & Technology (MPUAT), Udaipur. GAU was split into four universities in 2004 becoming: Junagarh Agricultural University, Junagarh;

academic council and are funded predominantly by the State, although they also receive a grant from the Central government via ICAR. Variations in the economies and budgets of different States can impact on the ability of SAUs to effectively address the research and educational needs of the State (Pal and Byerlee, 2006:182).

Aside from their own plant breeding initiatives, SAUs implement much of the plant breeding work of the various AICRPs. Each AICRP is headed by a Central Research Institute or, in the case of major/important crop types, a Crop Directorate[23]. These centres and directorates are responsible for coordinating the crop-specific research carried out by the various SAUs and research stations in their name, as well as 'back-stopping' strategic and some basic research that SAUs are unable or less able to carry out due to lower funding and research intensities (Pal and Singh, 1997). Crop directorates are governed by a research advisory committee, consisting predominantly of research professionals, and a management committee, whose members are drawn from a wider pool.

In order to coordinate commodity-oriented research activities across a country the size of India, ICAR, and in particular the AICRP system, needs to foster and maintain strong research linkages with the different research institutes and universities. Each SAU receives an annual grant from ICAR equivalent to 75% of the cost of the AICRP running costs (Pal and Byerlee, 2006:165). Research under the AICRP system is carried out and tested on a zonal basis often utilising SAU Zonal Agricultural Research Stations (ZARSs). The delineation of Agro-Climatic Zones (ACZs) has occurred in a step-wise process over time beginning with the creation of 15 Resource Development Regions by the Indian Planning Commission. These were further broken down into 131 sub-regions according to agro-climatic, edaphic and climatic considerations under the NARP (Ghosh, 1991). These ACZs also follow low level administrative boundaries of district and block (*tehsil*), where appropriate. The method of zonal classification varies depending on the organisation in question. Each State DoA and their SAUs follow their own zonal classification system; often according to their research station infrastructure. Since AICRPs work with multiple SAUs and research stations, they operate using their own zonal system which they use to carry out their varietal testing. The network of

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Sardarkrushinagar-Dantiwada Agricultural University (SDAU), Sardar Krushinagar, Banaskantha; Anand Agricultural University (AAU), Anand; and, Navsari Agricultural University, Navsari. JNKVV was split into three universities (2008/09) becoming: Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur; Madhya Pradesh Pashu Chikitsa Vigyan Vishwavidyalaya, Civil Lines, Jabalpur; and, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya (RVSKVV), Gwalior.

[23] I have visited the directorates of Rice Research (DRR), Maize Research (DMR) and Soybean Research (DSR).

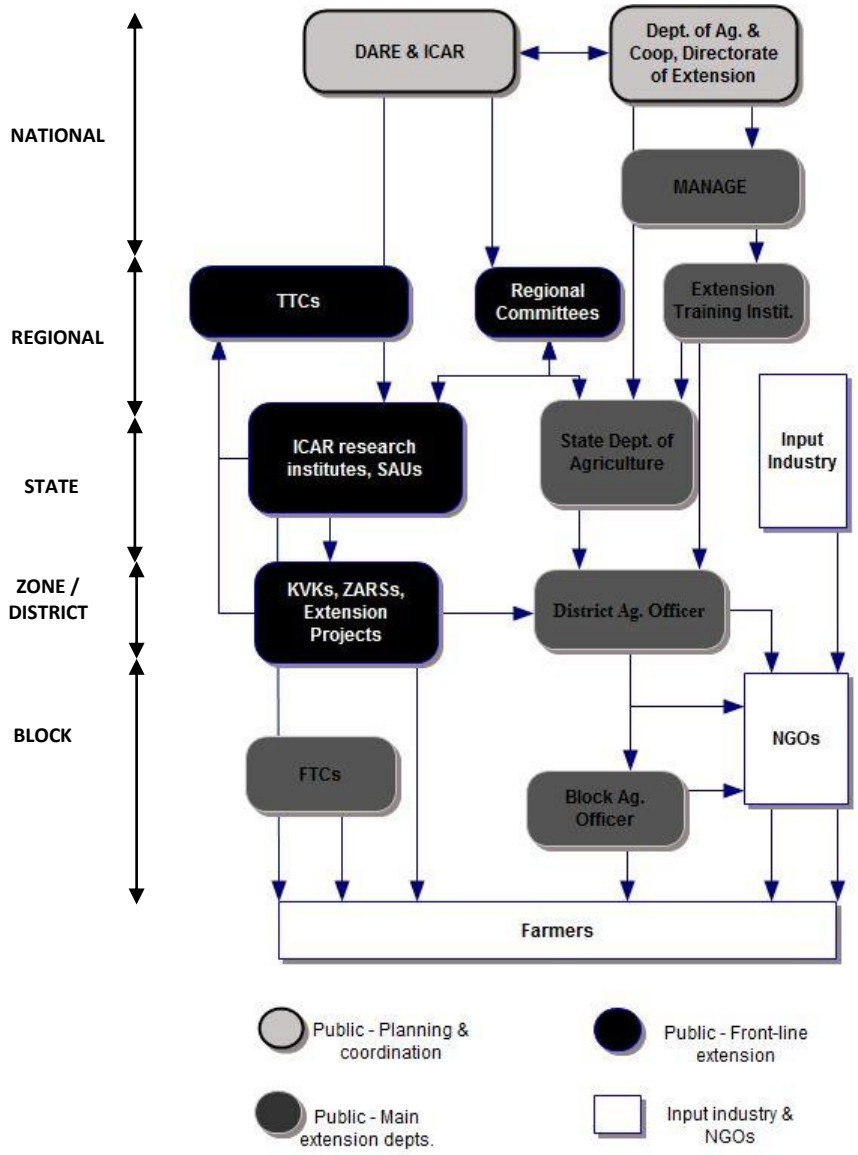
research stations and their locations not only condition the resolution and accuracy of ACZs, but will also impact on the suitability of crop types that are eventually released (Packwood et al., 1998).

Although the process of plant breeding is carried out by crop science researchers, the extension system is critical in the testing of new varieties; their dissemination to farmers; and the feedback of information back to scientists. Extension workers are also supposedly responsible for helping to refine the 'package of practices' associated with a variety through technology assessment and refinement (TAR). Pal and Singh (1997) broadly define four major components of the Indian extension or transfer of technology system:

1. Agricultural extension service with the state governments;
2. Extension education system of ICAR and State Agriculture Department system;
3. Extension programme of input industries in the public and private sectors and NGOs;
4. Special rural development programmes of the central and state governments.

As in the earlier section Pal and Singh (1997) have diagrammatised their understanding of the Indian extension system (Figure 6).

Figure 6 - Institutional Structure of the Indian Agricultural Extension System



Source: *(Pal and Singh, 1997)*

It is of note that in the late 1990s, Pal and Singh (1997), were describing an extension system that was built around the T&V system. Although the last phase of the NAEP and World Bank funding ended in 1995, resulting in a decline of the T&V system, it was this extension system that was in place prior to and during the first and second phase of the WIRFP. The national extension system is headed under the Directorate of Extension, part of the MoA, and the T&V system under the State DoAs (*Cf.* Misra (1990)). Training support given to extension staff under the T&V system was provided by ICAR institutes and the SAUs. The training of senior and middle level staff was overseen by the National Institute of Agricultural Extension

Management (MANAGE); and, at a regional level there were four regional extension training institutes and eight Trainers' Teaching Centres (for the training of KVK staff) (Pal and Singh, 1997). In 1997 there were 261 KVKs although this number has continued to rise as KVKs are seen as effective extension delivery institutes and funding for them has been earmarked by the Planning Commission in each Five Year Plan (*Ibid.*). At the end of the Tenth Plan (2002-07) 551 KVKs had been established, including 371 under SAUs and IARI, 40 under ICAR institutes, 88 under NGOs, 33 Under State Governments, three under PSUs and the remaining 16 under other educational institutions (ICAR, 2011). Due to their position in many districts KVKs are an important part of the extension network. Often KVKs find themselves implementing field trials and Front Line Demonstrations (FLDs) for crop programmes. The organisation that manages KVKs will in some part determine the degree to which it engages with farmers in a ToT mode[24].

The increase in number of KVKs represents one way the GoI seeks to improve the extension system in the post-T&V era through extending and broadening he types of organisation and institution that exist within it. Other initiatives include increasing the role of the private sector through Agriclinics and Agribusiness Centres – forms of Public-Private Partnership, the eChoupal model, Farmer Field Schools, and through the greater involvement of Civil Society Organisations (CSOs and NGOs), *inter alia* (*Cf.* Glendenning *et al*. (2010) for a more in-depth overview). These schemes and organisations are not discussed in further depth at this juncture since they are less likely to carry out extension functions relevant to the promotion of PCI.

4.3 Policy: Agriculture and Research

Narratives are a means by which actors often frame problems and pose solutions to them. They are important to policy by acting as a media for conveying important issues and garnering support for them. The T&V model itself was based on a narrative critique of the prevailing agricultural extension conditions prevalent throughout much of the world, many of which persist today, much as PCI is based on a second order critique of the ways in which plant breeding is carried out (Benor et al., 1984). Agricultural concerns are not found solely within the domain of agricultural policy since agriculture has the potential to generate both positive and negative externalities affecting other policy spheres such as the environment, national economy, food security and rural development, among others (Pretty et al., 2010). In India

[24] Experience on fieldwork showed that many SAU run KVKs operate in a ToT mindset.

these issues are intensified by vast inter- and intra state disparities in infrastructure, inequalities between farmers, and significant differences in agro-ecologies (Dev, 2008). Moreover, the recent rise of the private sector has sparked debate on the competitiveness, inclusiveness, sustainability and scalability of the different elements of the broader Indian Agricultural Research and Extension system, and the roles constituent organisations might have in forming new public private partnerships (Gulati, 2009a).

4.3.1 National Agricultural Policy

The Planning Commission (*Yojana Ayog*) is a government body that oversees the formulation of national policies through the creation of Five Year Plans (FYPs) concerning India's socio-economic development. With each Plan there has been a component pertaining to agriculture which detailed the Central Government's vision for addressing agricultural problems, its position and role in the national economy, and food security. Barring unforeseen national disasters such as war, the five year rolling plans have been ongoing since just after Independence. Much of the focus of the Planning Commission is on the efficient utilisation of limited resources in the face of severe ongoing budgetary constraints, and the coordination of activities between central government departments and the States. The Prime Minister chairs the Planning Commission and has a role in steering its direction. Members of the Commission include ministers, eminent scientists and persons from industry and the Chief Ministers of the States are also represented[25].

Each Plan starts with an approach paper, which outlines the macroeconomic dimensions, strategies and objectives of the Plan (Planning Commission, 2010). The approach paper then goes out for consultation among Central and State Ministers and acts as the basis for their respective plans. The approved approach paper is addressed by a number of agricultural Working Groups, Steering Committees and Sub- Groups, or Task Forces, which have been set up on a variety of different issues (*Ibid*). The make-up of these groups is drawn from Ministries, state governments, academics, private sector and NGOs. They then formulate their programmes and plans and send them back to the Planning Commission for review. The Planning Commission then reviews the National and State plans from the national and state governments and integrates them into the FYP. The FYP is then implemented through Annual Plans which details the resource allocation between the Central and State Governments. FYPs

[25] *Cf*. Planning Commission (2010) for more information on the Commission and how it functions.

undergo periodic mid-term appraisals to ensure that they remain on track, but otherwise remain unchanged for their duration (*Ibid*.).

This centralised method of planning has been critical to the evolving structure and continued functioning of the NARS. Not only have the FYPs been pivotal in channelling streams of money to ICAR and State Governments, but they have also altered the goals of agricultural research and the ways in which it is implemented. The first two FYPs were criticised by the World Bank for privileging Industrial over agricultural development. This imbalance was redressed in the 3rd FYP (1961-66) through the introduction of the Rockefeller-supported Intensive Agricultural District Programme (Parayil, 1992). Under the 3rd FYP the agricultural targets were not met and the 'traditional' approaches to agricultural development using traditional inputs were deemed by the Ministry of Agriculture to be defunct (Frankel, 1969). In 1965 the Ministry of Agriculture announced a new strategy for national self-sufficiency in food, the contents of which would later become known as the 'Green Revolution'. The new strategy was implemented in the 4th FYP (1969-74) by way of the High Yielding Varieties Programme (Parayil, 1992). The architect of the strategy was the then Minister of Food and Agriculture, C. Subramaniam, who was pivotal in forcing the reforms through in the face of an at times reticent Planning Commission. Payaril (1992) stated that some members of the Commission initially tried to block the introduction of HYVs from outside India thereby delaying their planting for a year. Despite this setback, the Green Revolution and the reforms made to ICAR during the process have become the mainstay and framework for much of the narratives, praxis and planning involving the agricultural research system to this day (Scoones, 2006: 23-29).

Although the Planning Commission, imbued with narratives of economic growth, scientific progress and stopping a neo-Malthusian food crisis, has been an important driver of agricultural policy change, well-positioned individuals such as Subramaniam can effect great change within the NARS. While it is expected that key actors, especially those in the top job, are able to reform and alter research trajectories and institutions, others that start off in lowlier positions, such as the late Verghese Kurien, have achieved similar influence. Kurien was the architect of the Indian 'White Revolution', also known as 'Operation Flood' (1970) which oversaw the creation and spread of a vast dairy development scheme that was formed around a then relatively novel co-operative model (Gulati, 2009a). The ideas and experiences of Subramaniam and Kurien in institutional development and reform originate outside of the aegis of the Planning Commission, but would later become entwined with it as their visions

became adopted by the central government plans or relied on its funding. A common thread that links both of these gentlemen was their being embedded within the Indian agricultural system at a time and with ideas with which they could convince others.

Insiders to a system often have a greater opportunity to effect change than those acting from without. However, as a developing nation, India has also been influenced by foreign institutions such as the World Bank and international development agencies that are able to provide funds to a struggling R&E system. Often the funds come attached with conditions concerning the altering of policy, such as in the case of T&V; or with the freedom to pursue a novel methodological programme, such as in the case of WIRFP and other development agencies. All are forms of outside interference that are at best welcomed, or at the very least tolerated, because the funds are needed and the programmes have marshalled together a convincing plan that targets specific problems with the system (Anderson et al., 2006: 8-9). In considering the MLP hypothesis of the strategic niche management model, these external interventions can be thought of as 'landscape processes' providing the impetus and pressure for the reconfiguration of the NARS regime.

ICAR does generate policy regarding types of research to be done. For example, in 1999 ICAR undertook a forecasting exercise and created a document entitled 'Vision 2020'. This was subsequently amended under the 'Perspective Plan 2025' and the latest incarnation, 'Vision 2030' was released in 2011. Each of the ICAR research organisations and institutes is responsible for creating its own version of the 'Vision' documents, which will then guide its research trajectories. However, when it comes to altering its organisations and institutions, the ICAR usually works together with the Planning Commission and MoA.

Since 2004 the Planning Commission has provided funding for five flagship schemes, some of which were based on previous schemes (See Table 11). The extra funding provided by these schemes is channelled towards agricultural projects and improving infrastructure, and there is a degree of freedom with respect to how individual states and organisations apply these funds. The National Food Security Mission (NFSM) with its links to ATMA and its 'participatory' component may be an avenue by which PCI projects can apply for funds, however it is up to scientists to determine whether a PCI project would be useful and draft an appropriate project proposal, and for this they have to compete with more well established research narratives within their own respective organisations.

Table 11 - Summary of Important GoI Schemes Providing Extra Funds for Agricultural Development

Schemes	Description
National Food Security Mission (NFSM) 2007 – present	Aims to increase productivity of core cereals (rice, wheat and pulses). Focuses on districts where productivity is below state average. Implemented in over 480 districts in 18 states. NFSM is a subsidy scheme for agri-technology including improved seeds, and is also coupled to capacity building through funding Farmer Field Schools and Field Demonstrations. Resource conservation technologies receive a special focus. Funds routed to the district level through ATMA.
Macro-Management of Agriculture (MMA) 2001 – present (with revisions)	A centrally sponsored scheme that aims to provide financial assistance for specific agricultural development interventions in the states. The scheme initially consisted of 27 centrally sponsored schemes relating to Cooperatives, Crop Production Programmes (for rice, wheat, coarse cereals, jute, sugarcane), Watershed Development Programme (NWDPRA, RVP/FPR), Horticulture, Fertilizers, Mechanization and Seeds Production Programme.
***Rashtriya Krishi Vikas Yojana* (RKVY)** 2007 – present	Agricultural investment as part % of GDP had fallen from ~5% in the 80s to 0.9% at the beginning of the Xth Plan. In order to achieve the target of 4% growth as laid out in the XIth Plan the RKVY scheme was formulated to rejuvenate Indian agriculture through increasing funding. It is mainly a project-oriented scheme but some money available for existing state-sector schemes. States have freedom to choose the projects that best suit them.
Integrated Scheme of Oilseeds, Pulses, Oil palm and Maize (ISOPOM) 2004 – present (with earlier incarnations)	To make the country self-sufficient in this important sector by increasing cropping area and yields. States have the flexibility to implement crop development programmes of their choice in a regionally differentiated approach.
Finance Commission Grants for Agriculture Projects	State Specific Grants created by the 13th Finance Commission to address a number of issues including marginal areas and groups of people. For the agricultural sector the Commission has put aside Rs. 754 crore for eight states.
Externally Aided Projects (EAPs)	EAPs directly coordinated by the DAC. Include projects funded by the World Bank, International Fund for Agriculture Development (IFAD), Japan International Cooperation Agency, German Technical Cooperation, *inter alia*.

Source: (DAC, 2012)

4.3.2 Seed Policy and Legislation

National agricultural policies have important effects on agricultural research, seed policy documents and legislation which impact directly on crop improvement research. There have been two seed policies that have contributed to the formation and alteration of new seed legislation (See Table 12). Legislation, once promulgated, can still be altered and refined, but it creates standards, principles and institutions that are difficult to repeal at a later date. This can present difficulties in establishing new research processes, such as PCI, which may conflict with elements of existing legislation.

Table 12 - Summary of Seed Policy Documents

New Policy on Seed Development (NPSD) (1988)	Concerned with putting into place mechanisms which support the sourcing and import of high quality seeds from abroad. In particular it makes provisions for strengthening and modernising plant quarantine procedures and facilities, with a view to strengthening the domestic seed industry.
National Seed Policy (2002)	Formulated to harmonise changes that had occurred in the national economy, international markets and domestic agricultural sector since the NPSD. It seeks to make provisions to increase competiveness of domestic seed industry, encouraging import and export of useful germplasm, enhancing seed production and quality assurance.

Source: (ICAR, 2010, DAC, 2012)

There are two types of similar seed legislation that strongly condition the way in which research and extension are carried out: the Seed Act and its associated reforms, and the PPVFR Act (See Table 13). Seed legislation and in particular the Seed Act construct standards related to seed quality so that farmers have access to high quality seed of an assured standard. The legislation also makes provisions for the creation of institutions and infrastructure at the state and central levels in order to deliver the goals of the legislation, such as testing laboratories, inspectors, seed certification boards, etc. (Table 13). Seed certification and the maintenance of physical and genetic purity are important factors in producing and maintaining high quality seed that is free from disease and weeds (Yasin et al., 2006). Seed certification is also important with respect to improving varieties as it makes it easier for agricultural scientists to ensure that the production gains from modern varieties are not diluted by poor quality seed. However, stringent seed standards also incur extra costs on the R&E system, and delay the time and reduce the quantity of seed that is available to farmers (*Ibid*.). The quality parameters of seed certification standards were borrowed from the experiences of developed

countries and may not be appropriate for heterogeneous Indian agro-ecologies and farming systems (Tripp, 1997, Witcombe et al., 1998, Yasin et al., 2006: 162)

Table 13 - Summary of Indian Seed Legislation

Legislation | Year	Summary
Seeds Act (1966)	Provides certification and minimum quality standards of notified kinds/varieties. The seed legislation authorises formation of advisory bodies like Central Seed Committee, Central Seed Certification Board and its sub-committees, Seed Certification Agencies, Seed Testing Laboratories, etc.. Seed quality control is to be achieved through pre- and post- marketing control, *voluntary* certification and compulsory labelling of notified kind/varieties. Criteria for the notification of varieties are stipulated in the Act, including standards for minimum limits for germination, physical and genetic purity (DUS criteria).
Seeds Rule (1968)	Expanded on and clarified aspects of the Seed Act, specifically regarding: • Functions of Seed Laboratories and Agencies. • Made labelling of any notified kind or variety of seed mandatory. • Anyone selling seed had to abide by labelling criteria.
Seed Control Order (1983)	Provides mechanisms for the mandatory registration of all seed dealers and the flow of seed production information and seeds across the country.
Protection of Plant Varieties and Farmers' Rights Act (PPVFR) (2001)	Makes provision for an Authority, an independent and permanent body with a broad-based composition, to protect plant varieties and farmers' rights at a national level; and a national register of plant varieties. Its purpose is to provide a mechanism to safeguard Intellectual Property Rights (IPR) associated with plant varieties in order to stimulate both public, private, domestic and foreign investment in crop improvement. This is India's implementation of a form of *sui generis* PVP legislation in accordance with its WTO obligations.
Seeds Bill (2004)	Includes: • Compulsory registration of varieties based on their yield performance to ensure the quality of seeds. • Accreditation of ICAR centres, SAUs and private organisations to conduct the performance of trials, maintenance of national register of varieties. • Provisions for self certification (accreditation of organisations for certification) • Accreditation of private seed testing laboratories • Regulation of export and import of seeds • Regulation of horticultural nurseries • Exemption for farmers to save, use, exchange, share or sell their seeds without registration and brand names • Provision of compensation to the farmer if seeds fail to perform according to their label. • Enhancement of penalty for major and minor infringements of the Seed Act. • Provision to regulate Genetically Modified (GM) crops and ban terminator seeds.

Source: (ICAR, 2010, DAC, 2012)

The PPVFR Act builds on the seed certification standards of the Seed Act and further strengthens the 'commodification' of the seed by public and private interests (Kloppenburg, 2005: *passim*). Although PPVFR safeguards the rights of farmers to save and grow their own seed, the introduction of an Intellectual Property Rights (IPR) regime favours current public and private interests in plant breeding, but does not make provisions for IPR related to PPB, i.e. farmer and scientist co-created varieties (*Cf*. ICAR guidelines on IPR (ICAR, 2006)). This lack of inclusion of PCI in the ICAR Guidelines may hinder if IPR becomes more important to the public sector in the future.

4.4 Plant Breeding as a Process

This chapter has so far focused on the evolution and structure of the agricultural research system as well as some of the policies which have helped shape it. Crop improvement, or more specifically plant breeding, is a process bound up within, and conditioned by, the larger research and extension system. Within the ICAR system it is located under the Crop Sciences Division, which in turn is divided into six commodity/subject-specific technical sections. Under the SAUs, research tends to be divided on a commodity basis between departments and specialised and generalised research stations (Pal and Singh, 1997). In both cases plant breeders work alongside other agricultural specialists, having to accommodate some of the professional norms and standards of their non-plant breeding colleagues. Plant breeding researchers tend to refer to farmers as a homogenous group and rarely differentiate between poorer and better-off farmers. Farmers who engage with scientists at research stations and on campus are routinely labelled by R&E staff as "progressive". Progressive farmers are more likely to be included in meetings with scientists, whereas poorer farmers who are unable to travel to the scientists are likely to be underrepresented or not represented at all.

The section below outlines the process of plant breeding in India by dividing it into three phases: the research process; testing and authorisation of the research product; and, the process by which it is disseminated to farmers. The section describes in outline the process of plant breeding as carried out by the SAUs. SAUs principally carry out adaptive plant breeding research, i.e. breeding new plant varieties for release within the state, and they also carry out a lot of the plant breeding work of the AICRP projects. SAUs were also the organisations which the WIRFP formed a partnership with for carrying out the PCI work during the project, so

understanding how they work and where they are positioned in the research system will help understand the potential for institutionalisation of PCI[26].

4.4.1 SAU Plant Breeding Research Process

The plant breeding research process can be represented as a linear flow diagram, at least with respect to the creation of a new plant variety. If viewed in a linear manner this process can take approximately a decade (Acquaah, 2007: 33). However, plant breeders do not create one variety at a time. When related to the activities of the plant breeder the research phase can be seen in terms of a cycle characterised by a number of activities in which there may be any number of potential new varieties at any one stage. The breeder can reduce the length of time that it takes to produce one variety through the use of technologies and plant breeding techniques and utilising the off season to grow several generations per year (Acquaah, 2007: 28). Those approaches are more labour intensive and costly so are not used in general but can be used when more money is available or when a new variety needs to be produced in a hurry.

Figure 7 provides a diagrammatic representation of key aspects of plant breeding research. The boxes illustrate the stages of plant breeding, while the labels show broadly how plant breeders source information for determining their research objectives. The details of the 'boxed' stages have been discussed in some depth in the literature review with respect to PPB and the principles are equally as relevant to conventional plant breeding.

One of the most closely guarded resources that plant breeders have is their germplasm library, much of which is planted out each year and kept *in situ* at research stations. When plant breeders are given or decide upon their new research objectives the first thing they do is consult their existing germplasm collections for suitable candidate genotypes to act as parents. If they do not have a variety with suitable traits they will try and source germplasm from other collections. The addition to and management of germplasm to a plant breeder's collection is an ongoing task and represents an important pre-breeding activity of plant breeders[27].

[26] All information in Section 4.4 is derived from interacting with SAU research and extension staff during fieldwork.
[27] Based on interviews with SAU staff at RVSKVV, MPUAT and AAU.

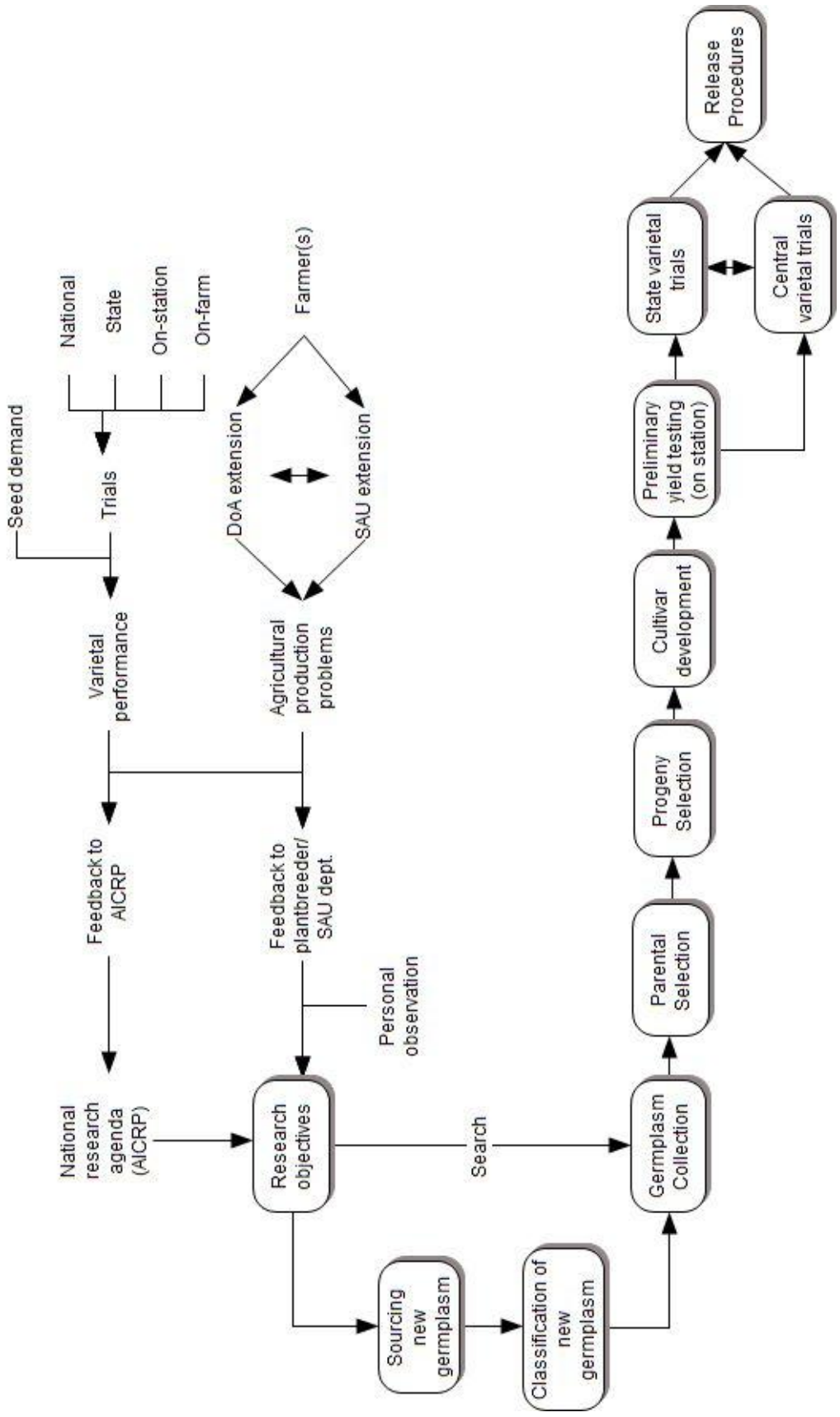


Figure 7 - Research Phase of Plant Breeding

Source: *Author*

Plant breeding consists of a number of stages that are largely dependent on the life cycle and genetics of the crop in question. These biological factors are in turn overlaid by scientific considerations and tests which seek to make sure that the new plant matches the technical definition of plant variety (see below)[28]. Each new candidate variety will need to satisfy a number of crop specific standards such as Value for Cultivation and Use (VCU) and Distinctness, Uniformity and Stability (DUS) criteria. These criteria are discussed below in Section 4.4.2; however they are worth mentioning now because plant breeders consider them when it comes to breeding new plants. For example, in order to meet DUS criteria, often breeders need to collect statistically relevant performance data for their candidate variety. Satisfying the DUS criteria hence significantly contributes to where and how plant breeding is carried out. It is easier for plant breeders to collect the relevant data on a research station than in farmers' fields. Likewise the crop specific VCU criteria will influence a breeder's decision to breed a variety with particular traits or put forward a candidate variety for state and central testing and eventual release. VCU and DUS standards are set by consensus within the plant breeding scientific community. The standards are intended to prevent the release and proliferation of similar, duplicate and/or inferior varieties while maintaining a measure of seed quality such that a released variety meets the criteria set out in its definition.

Other than the VCU and DUS considerations, the other main issues influencing the process of plant breeding are the formation of research objectives, which are in turn derived from feedback from a number of sources as well as by research agenda set by national crop improvement programmes. Although the majority of public plant breeding is carried out by state level organisations such as SAUs, public plant breeding is organized at a crop specific level through the AICRP system. Each AICRP centre adheres to a similar framework for managing crop development research, however, each directorate is free to set crop specific research priorities and is responsible for coordinating this research across all participating SAU centres. The research objectives of public plant breeders will largely be informed by the national research agenda for their crop through the relevant AICRP (Pal and Byerlee, 2006). Each AICRP is responsible for overseeing the national testing of candidate crop varieties

[28] A variety is "A sub-division (of a species) of a kind identifiable by growth, yield, plant, fruit, seed, or other characteristic. It also denotes an assemblage of cultivated individuals which are distinguished by a character (morphological, cytological, chemical or others) significant for the purpose of agriculture, or horticulture and which when reproduced (sexually or asexually) or reconstituted retain their distinguishing features." Yasin *et al*. (2006)

through the Central Varietal Trials system. They therefore have significant influence in determining VCU and DUS.

Public plant breeders will also receive some indirect feedback on the performance of their released varieties through the seed demand for that variety. Each breeder and institution is responsible for the production of breeders' seed for each variety that is released. Demand for different seed types is reported by each state's DoA and passed on to the AICRP centre which in turn forwards the figures to the relevant organisation that is responsible for the breeder's seed. Through this mechanism plant breeders can assess how popular their newly released varieties are; and if demand is lower than expected, they can make enquiries through extension staff to see if there is a problem with extension or whether there are aspects of the variety that are not desirable to farmers. However, seed demand is only an indirect measure of varietal popularity and suitability since it is dependent on the efficiency and reach of seed distribution and marketing networks to accurately convey true demand. It does not account for farmer seed saving practices of poor and subsistence farmers, the total amount of seed multiplied by other organisations, or those farmers too poor to purchase new seed (DAC, 2012: 51).

Plant breeders also have access to the trial performance data for any candidate variety that they produce. This information can be used to alter future breeding strategies, if a variety fails to be released. Breeders also receive information from KVKs regarding the performance of their varieties on research farms and in farmers' fields. KVKs have some responsibility for carrying out Technology Assessment and Refinement (TAR) (Glendenning et al., 2010:17). The KVKs will test new varieties released for their area on KVK farmland to see whether the variety is indeed appropriate for that area. If the variety underperforms then agricultural scientists from the university are consulted in order to develop a "package of practices" for cultivation that would better suit that variety. The results of ongoing TAR programmes can help to inform breeders of how their varieties are performing.

Breeders are also exposed to specific farming problems through their extension worker colleagues at the SAU and in the DoA through Zonal Research and Extension Advisory Committees (ZREACs). Two important issues involving the setup of the ZREAC concern the degree of farmer representation in decision making and how this information is processed and presented to plant breeders. There are two annual ZREAC meetings that occur prior to each season (*rabi* and *kharif*) at the SAUs to discuss forthcoming agricultural issues and research

objectives for the zone. These meetings are attended by one or two “progressive” farmers. Farmer representation is therefore far from representative or proportional at these meetings. The term “progressive” suggests that the farmer is an adopter of current research outputs. The absence of subsistence and smallholder farmers from these meetings suggests that the specific agricultural production issues of these two demographics are not properly considered. During these ZREAC meetings agricultural problems and research agendas are discussed by a multidisciplinary team of research scientists, and extension staff from the state DoA. Plant breeders attending the meetings receive information from the field that has been filtered up through the DoA extension officer hierarchy. Since time is a limiting factor in these meetings not all research problems will be reported on, and those that are will represent what the extension staff deem most pertinent.

The ZREAC meetings are also occasions during which the zonal package of practices booklet can be updated. These booklets contain university-sanctioned agronomic practices and plant varieties suitable for different agronomic conditions within the ACZ. The package of practices usually outline both more and less-intensive agrochemical input oriented approaches towards nutrient and pest management to broadly suit the needs of different farmers – although the focus of the booklet is largely on the former. If an agronomic problem affecting a region within the ACZ is raised in the ZREAC, the issue will be discussed by the multidisciplinary team of scientists present. What tends to happen is that the package of practices guide will be consulted and the relevant specialist will suggest an alteration of the crop management protocol that they, along with the KVK, will test. If the results of the experiments are positive they will update the package of practices accordingly. This convention suggests that agricultural problems which are raised are more likely to be addressed by one of the multidisciplinary team rather than the plant breeder. This makes sense in the short term since plant breeding is an activity that takes time to carry out and may not yield a relevant variety in enough time to satisfy the immediate needs of farmers.

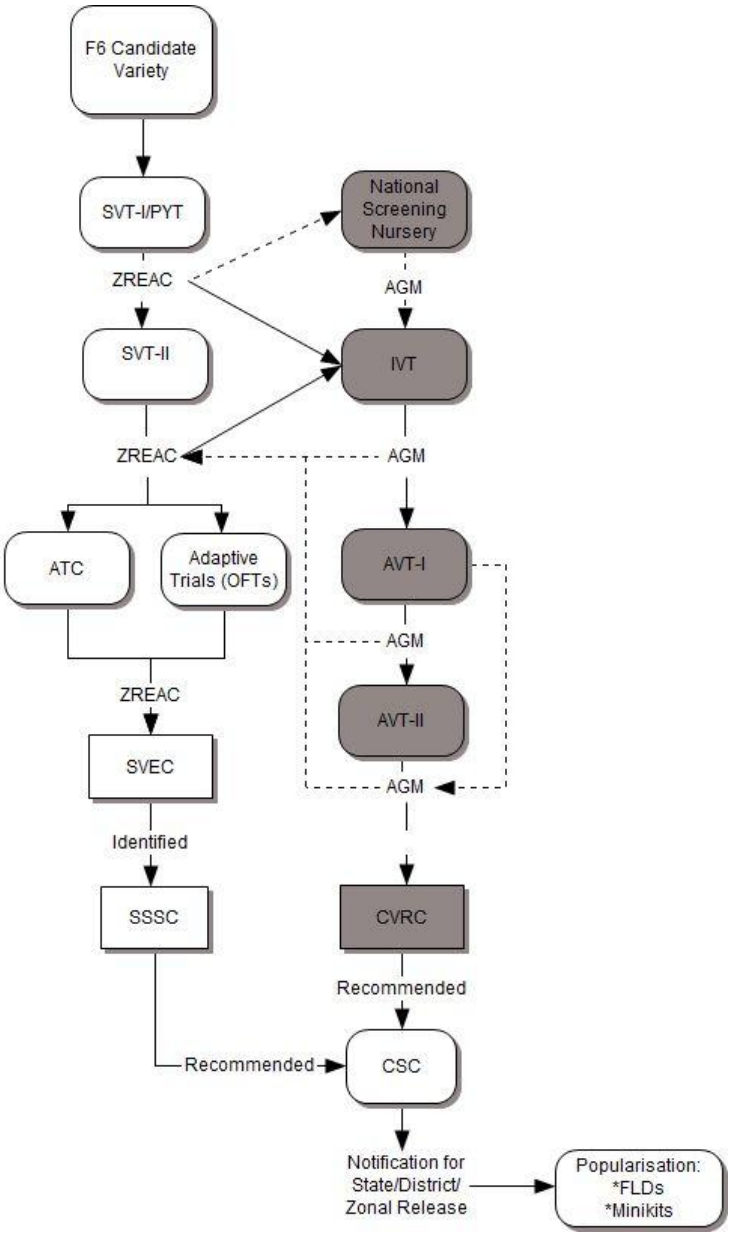
While the ZREAC is a platform for addressing selected zonal research problems, the way that they are structured is not necessarily the best way of addressing plant breeding research priorities since any information from farmers is first selectively filtered through the extension system. This approach prioritises technological and external agrochemical input focused responses to solving agricultural problems instead of breeding new varieties that could help with the problem. The latter being potentially better suited to smallholders and subsistence farmers who cannot afford to adopt those technologies.

4.4.2 Varietal Testing and Authorisation Process

Candidate crop varieties are released only after they have undergone rigorous processes of testing. During testing, data are collected on the performance of the variety across a number of different soil types and agro-climatic conditions. Scientists compare the data with the performance data of other candidate varieties and a non-specific number of check varieties. The check varieties are usually the best performing variety or varieties for the ACZ and soil environments for which the candidate varieties are being tested. One of the check varieties will often be the local *desi,* traditional/landrace, or local crop 'variety', which is popular with farmers in that region. At the end of each season the data on the candidate varieties are collated by the plant breeder and discussed in the relevant testing committees. If the candidate variety has performed well and met the relevant criteria, it will be promoted to the next stage, subject to approval by the ZREAC committee. Each committee acts as arbiter for deciding whether the candidate varieties presented before it can pass on to the next level of testing (Yasin et al., 2006).

There are two systems of varietal testing and seed/variety certification: the state and national release systems. Both of these systems are closely linked to the public plant breeding institutions so any private companies or NGOs wanting to lawfully release their own varieties still have to use these systems. Private companies and NGOs do have recourse to a clause within the Indian Seed Act (1966) that allows them to release seed outside of the public seed certification systems as long as it is labelled as Truthfully Labelled (TL) seed. In order for seed to be described as TL it must meet the minimum seed certification standards for genetic purity and be correctly labelled. Responsibility and liability for quality control is borne by the company which produces and markets the seed.

Figure 8 - Flow Diagram of Central and State Varietal Testing Pathways



Source: *Author*

Key: *Grey boxes represent the Central varietal trial system. White Boxes represent the State varietal trials system.* Arrows denote the progression of varietal testing. Dashed lines denote optional pathways a candidate variety can progress.

Figure 8 diagrammatically represents the state and national varietal release systems. Each state has a slightly different system for testing candidate varieties in terms of the names of stages, but they are very similar in structure. In the diagram the state system is represented principally by the white boxes and the national system by the grey boxes. One of the principle

aims of plant breeders is to get their candidate variety released nationally since this carries higher professional prestige and the variety is more likely to be recommended for release across a wider area and therefore grown by more farmers. The starting box refers to an F-6 generation – this is a variety that is suitably stable enough to enter into the testing system, usually after five to six years.

The main pathway of plant breeding consists of a number of trial stages and committee meetings. In each meeting the results of crop trials are discussed by a committee which decides whether to reject the variety or promote it to the next level of trials. In the national testing and release system trial plans and results are discussed during the Annual General Meeting (AGM) of the relevant AICRP. At the state level trials are usually discussed as part of a seasonal ZREAC meeting – rather than in a crop specific workshop.

The Distinctness, Uniformity and Stability (DUS) tests for a candidate variety are carried out across a number of years and are multi-locational. On the basis of DUS testing, a varietal descriptor is generated for identifying the variety in farmers' fields and during seed inspection (Yasin et al., 2006). DUS testing is important for authorising new varieties as it ensures that all candidate varieties meet the definition of a crop variety. DUS criteria differ between crop species; cross pollinated and self-pollinated crops; hybrids and non-hybrids; however, the criterion for a particular crop type is set by national crop directorates and influenced by international standards (*Ibid*.).

When a candidate variety has been developed to a plant breeder's satisfaction, they will trial the variety for one year on the research station where it was developed. This is the first stage of varietal testing and is generally called a preliminary yield trial (PYT). After each trial the results are discussed in the ZREAC and a case is made by the plant breeder for releasing the candidate variety. The role of the committee in this instance is to assess the trial data and release proposal in order to make sure that the data contained within it are scientifically valid and will be accepted at the next committee level. The committee will then make suggestions regarding altering the proposal or collecting more data to improve the case for varietal release.

In both the national and state trial systems, varietal testing is carried out for a minimum of three years. During this time several different trials may be carried out including research station trials; state multiplication trials; disease/pest screening trials; multi-locational trials;

agronomic / adaptive trials; minikit trials; on-farm trials and front-line demonstrations (FLDs). In the national AICRP trial system the first trial is called the Initial Varietal Trial (IVT). In this trial all of the candidate varieties from across the country for a specific crop type are evaluated against each other in different ACZs. The IVT is designed to diminish the number of candidate varieties according to their yields. New varieties should improve on the yield of the current best variety by approximately 10% in order for them to be considered for release. The IVT will influence the different ACZs in which the candidate variety performs best. Should a candidate variety be successful in its IVT, it will be promoted to Advanced Varietal Trials (AVT) for two years. AVT trials will further test the performance of a candidate variety only in the ACZs in which it performed well during the IVT.

The state trial system is organised in a different way to the national AICRP system. After the PYT, multi-locational testing is carried out at different research stations across the state. These research station trials are often called Station Varietal Trials (SVT) although the trial names and acronyms may differ slightly across states. The different research stations within the state are strategically situated within different ACZs and so mirror the multi-locational testing of the AICRP system albeit with fewer varieties and at fewer locations (Yasin et al., 2006). The state varietal trial system is similar to the central one in that each candidate variety requires a minimum of three years testing. However, it also has an adaptive component in that it is mandatory for candidate varieties to be tested on farmers' land prior to release. In the past, front-line demonstrations (FLDs) using candidate varieties were carried out in conjunction with adaptive and on-farm trials prior to varietal release. In my research I found that this practice was almost non-existent, on account of a fear among scientists regarding the potential biopiracy of unfinished varieties by private organizations from farmers involved in the testing process. It is now therefore rare for researchers to receive feedback from farmers regarding their candidate variety prior to its actual release. The main role of FLDs is as an extension and popularisation tool as opposed to a mechanism by which researchers can gain insight into the suitability and desirability of their varieties with respect to different demographics of farmers.

When a candidate variety successfully negotiates the central or state trial systems and proved its worth, it will be 'identified' by the relevant committee. The term 'identification' means that the candidate variety has been found by the committee to be superior to the current best varieties. The main criterion for superiority is grain yield and this is assessed across a number of ACZs in order to ascertain whether a variety's performance is narrowly or broadly adapted.

Apart from yield, other factors that may be considered include: the degree of agro-environmental adaptability, resistance to biotic and abiotic stresses, quality attributes, responsiveness to inputs, and other economic traits. These factors constitute a candidate variety's Value for Cultivation and Use (VCU) and the degree to which these factors impact on the identification process is determined by the relevant committee and the plant breeding agenda of the supporting organization – the crop directorate in the case of AICRP or SAU at the state level.

Once a variety has been identified for release within the ZREAC or AGM, the release proposal will be written up on the relevant prescribed *proforma* before being presented to the relevant State or Central Varietal Release Committee - SVRC or CVRC respectively. The two committees differ in their jurisdiction with the SVRC being responsible for release of varieties within a particular state or zones within a state, and the CVRC being responsible for the release of varieties throughout the whole of India, or again within specific ACZs at a national level. The SVRC and CVRC make 'recommendations' for release of candidate varieties to the Central Sub-Committee on Crop Standard, Release and Notification of Varieties (CSC). The CSC screens all varietal release recommendations it receives before it declares them officially released through their "notification" in the National Gazette. Seed production of a variety can only be taken up by the relevant organizations only after it has been notified.

4.4.3 Dissemination Processes

After the release of a variety there are two main activities which, together make up the dissemination phase - seed production and extension. While plant breeders have an active and direct role in at least some of the stages of seed production, they have a more indirect role in extension.

Once a variety has been notified in the National Gazette the process of seed production can begin. Seed production is an important aspect of any crop improvement programme. It is at this stage that the benefits of novel varieties can be scaled-up and disseminated to farmers. For farmers to gain the benefits of novel varieties they must receive seed that has a high genetic purity and that of good quality. Genetic purity and seed quality are dependent on the biological, physical and technical factors along the seed chain (Kadam, 1942).

Table 14 - Seed Classes

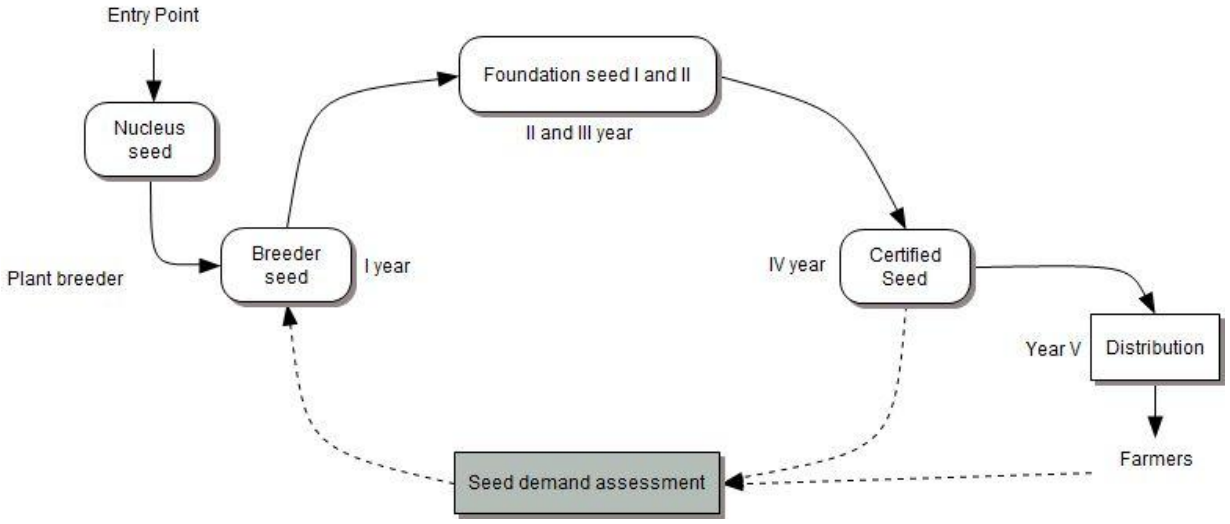
Class	Description	Producer / Supervisor
Nucleus seed	Cent per cent genetically and physically pure seed. Quantity of available nucleus seed is in kg.	Concerned plant breeder
Breeder's seed	Progeny of nucleus seed. Same levels of purity monitored by breeder and a committee. Breeder's seed is that which is multiplied up for use by seed producing agencies.	Concerned plant breeder or sponsoring institute. Quality is monitored by state or central government organization.
Foundation seed	Progeny of breeder's seed. It has genetic purity >98%. Foundation seed is purchased by Seed Corporation from seed growers. Foundation seed can again be multiplied by the Seed Corporation in the events of it s shortage with similar seed certification standard.	Recognised seed producing agencies (public/private) i.e. government farms or private seed producers. Quality assessed by seed certification agency.
Certified seed	Progeny of foundation seed produced by registered seed growers under the supervision of the Seed Certification Agency.	Registered seed growers.

Source: (Yasin et al., 2006)

Seed multiplication is a graduated affair which results in different classes of seed being produced. Table 14 lists the major classes of seeds and their descriptions. With respect to scaling up the quantity of seed available to farmers, the concerned plant breeder is responsible for and involved in the generation of nucleus and breeders seed. The process of producing nucleus and breeder's seed each season is managed by each state through coordination with the relevant SAUs and AICRPs, and the state extension systems.

The process of producing seed for farmers is subject to a degree of lag brought about by having to scale up small quantities of nucleus and breeder seed to meet the seed demand of farmers across a larger area, i.e. the state. This seed multiplication process in the Indian context is referred to as a seed rolling plan, as represented graphically in Figure 9. The nature of multiplying seed means that there is inevitably a four to five year delay, depending on the crop type, between receiving a seed demand assessment and producing the required amount of seed.

Figure 9 - Entry of Seed Chain into Seed Rolling Plan



Source: *(Yasin et al., 2006)*

Key: *The diagram represents a 'seed rolling plan' in which any seed demand assessment will take four to five years to reach farmers.*

The lag between receiving a seed demand assessment and producing the required amount of seed means that the amount of seed produced is only an estimate of the actual demand at that particular time. There are numerous intercalated and co-dependent factors that affect the demand, production and supply of seed. While they are all relevant to the supply of appropriate seed; at this juncture I shall only discuss a few issues that are of greater importance to plant breeding.

In the case of Madhya Pradesh (MP) the seed rolling plan in its current format is characterised by numerous problems. Demand for seed can vary for a number of reasons which are difficult to predict accurately – two such examples of this would be issues such as fluctuating market prices, and the late collection of seed demand data from farmers by Agricultural Officers (AOs) so that this information may be unavailable when needed. Inaccuracies inherent in capturing and forecasting seed demand, coupled with the inability to accurately determine the yield gaps and shortfall of certified seed at the end of the seed production system, suggests that it is difficult for plant breeders to gauge true farmer demand for their varieties from the breeder seed indent. Breeder seed indent however remains the main way for plant breeders to indirectly assess the popularity of their varieties across the state and India.

Embedded within the concept of seed multiplication and dissemination is the agronomic concept of Seed Replacement Rate (SRR). SRR is the percentage of certified seed of a crop sown in an area out of the total area planted under that crop. A high SRR suggests that new certified seed is grown in the total cultivated area for that crop, whereas a low SRR indicates the opposite. Scientists may blame low SRR figures on a failure of agricultural extension along with the illiteracy and poverty of farmer demographics as factors contributing to a low SRR (Yasin et al, 2006).

What the SRR figures cannot explain is whether low SRR is due to inefficiencies in the crop improvement and seed multiplication chains; ineffectual extension; or whether the suitability of the crop varieties and associated packages of practices themselves are at fault. This ambiguity and inability to ascribe a principle causal factor to low SRR and adoption rates allows for a situation in which researchers can blame the delivery of the research product or the nature of the farmers themselves as reasons why adoption of new varieties is low; rather than the potentially less palatable notion that it may be their research which is not appropriate for certain farming systems or farmer demographics. After all, the new varieties have passed through a rigorous scientific testing regime; albeit one that has very little direct involvement of farmers.

4.5 Discussion

Sub-Research Question 1:

> *What are the core socio-technical practices which characterise the Indian public plant breeding regime, and how do they govern the ways in which plant breeders carry out their research?*

The information reported above contributes to answering the first research question. Despite institutional differences, the core socio-technical practices affecting a public-sector plant breeder are largely similar whether they work for an ICAR institute or an SAU. One of the major differences between an AICRP crop directorate and a SAU is that the former's role is oriented more towards carrying out basic science and supporting the SAUs in their work, whereas the latter is concerned about breeding plant varieties relevant for the state (applied

science). The AICRP system is an element of the research system that coordinates crop-specific research across the country and involves both ICAR and SAUs jointly.

At the start of this chapter I stated that the phrase "history matters" is important with respect to how institutions evolve and how their organisational behaviour is locked into a path dependent on their history. The history of the Indian NARS points to a number of long established institutions, divisions of labour and attitudes which condition the way in which plant breeders operate. Separate state departments of agriculture allow for states to have a degree of flexibility in how they fund and implement their research and extension (R&E) activities. Despite this, state level R&E activities often mirror the breeding agenda outlined by the ICAR system through the AICRP system. The central R&E system is also closely linked to the Planning Commission with its agenda of enhancing agricultural productivity. Through the Planning Commission the central government can provide extra funds via subsidy schemes to enhance agricultural productivity in different states targeting different crops through different mechanisms. The agricultural subsidy schemes again provide some flexibility regarding how the funds are disbursed; however, it is up to research institutes to develop project proposals which are in turn conditioned by the dominant research narratives within these organisations.

SAUs are mandated by the state departments of agriculture to carry out research, extension and education activities for the state. In every season and within every month a plant breeder is required to carry out multiple crop breeding and seed multiplication activities that revolve around the life-cycle of the crops and the stages of breeding that they are involved with (Yasin et al., 2006: 139-142). The higher the professional level of a plant breeder within an SAU the more educational, supervisory and administrative responsibilities they will have. This can impact on a more senior plant breeder's ability to carry out actual physical plant breeding activities on a research station or farm. Moreover, the profession of plant breeding is a long established division of labour which physically separates the act of research from the delivery and marketing of finished research product. The division of labour that exists between plant breeder and extension scientist/officer undoubtedly confers organisational efficiencies of an enhanced capacity for specialisation and skill enhancement within each profession. It also reduces the amount of time that plant breeders are in actual contact with farmers and the time spent travelling to meet them. In light of the busy work schedules of plant breeders, reduced contact with farmers is not necessarily a bad thing *if* there are appropriate *knowledge management* mechanisms in place in order to provide plant breeders with information on farmer desired crop traits and the more general needs of the market (consumers and

industry). This latter group are easier to engage with since consumer groups and industry lobbyists can approach the SAU or state agricultural department and make their needs known.

The majority of plant breeders interact directly with farmers only if they visit their research stations or occasionally during FLDs or OFTs. The majority of information from farmers comes to plant breeders via the extension system. What information is sourced from farmers, what type of farmer is approached, and how this information is collated, synthesised and presented to plant breeders are issues which will collectively determine what breeding objectives a plant breeder will pursue. There are two *fora* at which plant breeders discuss breeding objectives at the SAU – the ZREAC and departmental meetings. Both these meetings provide opportunities for research to be discussed and information to be fed back from farmers' fields, however, it is not the sole purpose of the meetings and much of the meeting is given over to discussing research rather than how it is performing. So although plant breeders have multiple mechanisms for trying to understand what farmers need, there is no systematic method for collecting information which considers different locations, types of farmer, their agro-ecological and socio-economic contexts within the state. This is further compounded by relying on an extension system which has a limited reach and mainly acts as a passive transferor of technology (*Cf.* Glendenning *et al*. (2010: 26)).

The poor functioning of the information channel emanating from farmers to plant breeders via the extension system has a lot to do with *user relations* and *accountability* within the NARS, and is also linked to the persistent and pernicious transfer of technology (ToT) *narrative*. ToT in its own right is not a problem if it involves good technology that is appropriate to the needs of a target farmer demographic or type of farming system. However, ToT and the 'lab-to-land' mantra that it often co-exists with come with an inbuilt assumption that the technology itself is largely irreproachable since it has been tested and legitimised by passing through the varietal trial system. The *user relations* that exist between SAUs and farmers depend largely on the ability of scientists and farmers to interact. Staff at SAUs are more likely to have interactions with 'progressive farmers' than resource-poor farmers, because the former have a greater capacity to meet SAU staff at research stations and at KVKs. In contrast, resource-poor farmers may be more isolated and less likely to adopt the package of practices approach and are conversely labelled 'backward'. However, plant breeders can and do present their interaction with and inclusion of 'progressive farmers' in research meetings as evidence that they do consider the needs of farmers, even if the interactions are tokenistic, selective and often *ad hoc*.

Poor and selective *user relations* in SAUs are hindered by a lack of *accountability* towards farmers in general. ICAR has a strong accountability to national agricultural policies such as those found within the successive five year plans, which often contain targets for increasing the growth of the agricultural sector. The state departments of agriculture and the SAUs are charged with improving the agricultural scenarios of their respective states. However, their research agendas for specific crops tend to mirror those of the ICAR AICRP crop directorates. Moreover, at the state level there are very few mechanisms for generating accurate information about the suitability of new agricultural technologies with respect to the needs of all the state's farmers. Plant breeders might have access to aggregated seed replacement rate data, mean varietal ages, breeders seed indents for their varieties, and the results of on-farm trials (OFTs). However, the OFTs take place on research farms under the recommended package of practice, and the other indicators are indirect measures for assessing the appropriateness of the variety – they do not preclude the option of an ineffectual extension system as being the cause of poor varietal adoption. This can act as recourse for those wishing to defend the current output of novel varieties because based on current information it is impossible to rule out an ineffectual extension system as the cause of poor adoption of new varieties by farmers.

Since plant breeders only have ephemeral lines of communication with farmers, much of their work is legitimised by testing their varieties through the varietal testing system. Seed quality and purity are *regulated* through *legislation* such as the Seed Act. In stipulating minimum levels of quality and genetic and physical purity, the legislation upholds a rigorous definition of the term 'crop variety' which may differ from the traditional practices of farmers who save seed. There are obvious benefits to promoting and adhering to these standards since they act to safeguard the genetic gains of novel varieties. However, the testing and release process with its standardised and strict crop-specific VCU and DUS requirements greatly conditions the *praxis* of plant breeders by making the research process largely oriented towards trying to produce varieties that will navigate the testing system. The national AICRP trials and various state trial systems do allow for some flexibility with respect to how varieties can be released. Based on its performance in the national trial system a candidate variety may be recommended for various ACZs across the country. Each individual state has its own varietal release system and although they are equally stringent with respect to performance, it is easier for a plant breeder to make a favourable varietal release proposal which contains VCU criteria that address particular identified problems within the state.

Both the national and state varietal trials systems privilege the public sector over NGOs and the private sector since public R&E scientists act as custodians and gatekeepers on varietal release committees. This can make it difficult for outside agencies to get their own candidate varieties tested and released within the public system, as it is difficult to determine whether the information collected by the outside agencies on the performance of the candidate variety is sufficient to satisfy the different committees. The trial systems represent a form of behavioural lock-in and path dependency within the Indian NARS that poses a barrier to working with outside agencies, while it also self-legitimises their own varieties without a need for direct accountability to the whole *range* of farmers found across the states.

This discussion has shown that an analysis of the historical development of the Indian NARS can provide insights into its contemporary institutional structure, hegemony, and the boundaries of permissible and potential action that different actors may work within. The issue of chronology is salient as it can show how an institution has developed to address particular problems. An institution's intransigence in the face of changing circumstances may result from difficulties faced by staff in substantially manipulating organisational forms once they have been created and invested in. Moreover, in an organisation such as the Indian NARS, there are few actors of significant stature at the periphery that have the power to change the boundaries of what is permissible in terms of research and extension praxes.

This is also compounded by the issue of distance across which knowledge and influence may travel. There are physical and cultural distances between farmers, R&E staff and politicians. The division of labour between R&E specialities also creates a distance through the separate, though sometimes overlapping spheres of influence that the professionals operate in. Furthermore, there is the physical separation of hinterland farmers, research stations and SAUs from each other and from the central powers which to varying degrees dictate their actions. Closing these physical and social distances and opening channels for communication and knowledge transfer are essential considerations if power is to be leveraged from actors in the centre to effect organisational change for the benefit of those at the periphery.

The next chapter will characterise the development of the WIRFP and the development of the PCI niche. It will build on the information reported on in the chapter by showing how the WIRFP collaborated with the public plant breeding regime.

5 PCI Niche Development and Regime Engagement

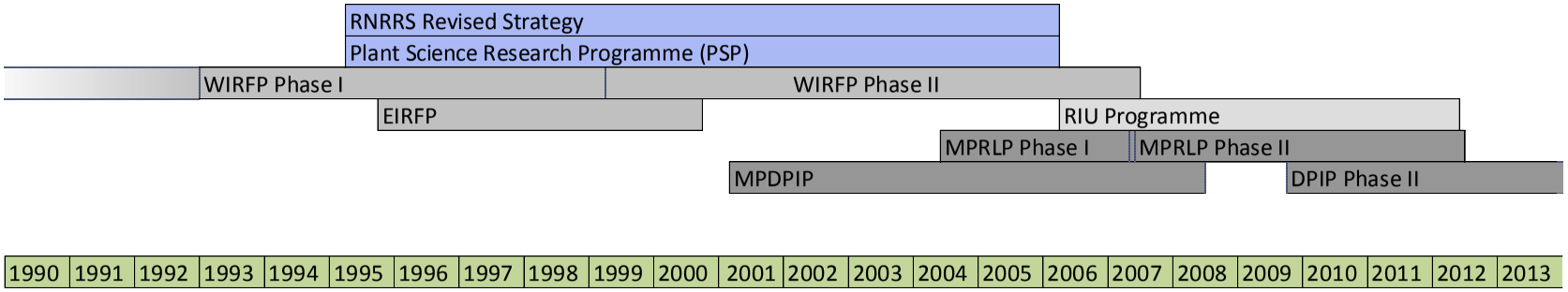
5.1 Introduction

The year 1990 marked the start of an epoch in crop improvement research that would challenge the conventional assumptions and narratives of agricultural researchers, plant breeders and policy makers. In the parlance of SNM theory a series of events helped form a socio-technical niche that acted as a potentially protected space within which the process innovations of PVS, PPB and more general participatory development interventions, might be nurtured. As the niche developed and matured it potentially could create opportunities for and make efforts to interact with the dominant socio-technical regime – the Indian NARS; test some of its strongly held narratives; and try to scale-up and institutionalise its reformed type of crop improvement.

In this chapter I outline and chart the major events along this PCI innovation trajectory, and illustrate that account with the example of the WIRFP. To this end the chapter is divided into two parts corresponding to the first and second phases of the WIRFP and the activities preceding it. These divisions define important periods in the development of the PCI approach. It will become apparent that the WIRFP represented a continuum of activities central to the development of PCI. The niche, however, consists of multiple projects occurring in parallel to the WIRFP but at the same time reliant on it for its resources including physical and human capital and the less tangible knowledge products generated by the project. The WIRFP can be thought of as both a physical and conceptual anchor with which to plot the development of the niche and its constituent projects. Figure 10 presents a timeline of the WIRFP and some of the important research and development programmes associated with it that will be discussed throughout this and the following chapter.

Although this section takes the form of a chronological account, salient events will be singled out and their importance elaborated on with respect to the socio-technical dimensions outlined in the conceptual framework. The RIU Programme engaged some of the original WIRFP and EIRFP actors in a project aimed at enhancing the benefits of the crop programme but with a focus on the provision of seeds as opposed to more plant breeding activities. This phase of niche activities will be discussed in greater depth in the following chapter on the legacy of the niche, but is mentioned here to foreshadow that discussion and bring the niche activities up to the present date.

Figure 10 - General Timeline of the WIRFP and Niche-Associated Programmes



Source: *Author*

5.2 The WIRFP Phase I (1992-1999)

5.2.1 KRIBP Background and Overview

During the first phase of the project the WIRFP went by the name of the Western India KRIBHCO Indo-British Rain-fed Farming Project (KRIBP). The reason for the change in name stemmed from a reorganisation of the role and structure of the project implementing organisation at the end of the first phase[29]. The KRIBP officially began in January 1993, however project planning was started after a mission in July to August 1990, with more detailed planning taking place after pre-project activities in 1991 and 1992. KRIBP was financed by DFID, formerly the Overseas Development Administration (ODA), in a bilateral agreement with the GoI. The first phase of the project was initially projected to run for four years till 1996/97 with a budget of £3.51 million (*Ibid.*).

Much of the early project focus and rationale was set out in the KRIBP Working Paper No. 1 (Jones et al., 1996). The project architects framed the rationale for the project around a critique of the Green Revolution and ToT extension methods as applied to rain-fed areas. They acknowledged the good that the Green Revolution had brought India in terms of food grain self-sufficiency since the 1970s and an end to intermittent famines thanks to irrigated cultivation and modern crop varieties, but questioned whether this approach was useful or appropriate for rain-fed agriculture, which, invoking Chamber's (1989) terminology, they described as complex, diverse and risk-prone (CDR). Indeed, much of the rationale for the project was drawn from the narrative arguments found in *Farmer First* (*Ibid*.). The authors argued that while ToT and standard methodologies may be useful in high potential production systems, in rain-fed areas, "... it should be complimented by scientists working closely with farmers in order to (a) assess their needs and priorities and then (b) engage in a process of 'search' and development in order to provide technologies which meet their needs." (Jones et al., 1996: 5) In 1990, when the project was being planned, there were very few participatory agricultural research projects being carried out and these were mainly experimental in nature. KRIBP was an ambitious early attempt at testing the hypothesis that greater farmer participation would develop appropriate technologies and institutional linkages that will positively affect the livelihoods of farmers in marginal environments.

[29] The events leading up to the change in project nomenclature will be discussed in Section 5.3

The project planners drew specific attention to KRIBP being a 'process' project, in that although the broad aims, objectives and outputs of the project had been pre-decided in a logical framework, there was no blueprint to how they were to be achieved. Instead they should be decided in a collaborative and participatory manner between farmers and project staff (*Ibid*.). The authors listed five broad aims of the project which can be compared with the project objectives laid out in Box 2; these aims are as follows (*Ibid.*):

- The development and implementation of a participatory and poverty- and gender-focused approach to planning and implementation of farming systems development;
- The improvement of livelihoods of poor families in the project area by identifying, testing and making available agricultural technologies, which are appropriate to poor farmers, including women;
- The strengthening of state agricultural university research centres in each district to undertake research relevant to the needs of poor farmers;
- The co-ordination of research and extension activities undertaken by governments organisations (GOs) and non-government organisations (NGOs);
- Training of project staff, farmers and *jankars* (village volunteers) in participatory and technical skills.

Box 2 - KRIBP Project Objectives Derived from the Original Logical Framework

Wider Objectives:

1. To promote a replicable, participatory, poverty-focused and environmentally benign approach to farming systems development by KRIBHCO and its adoption by other organisations in India.
2. The active use by project villages of long-term links with government and other outside institutions to satisfy their development needs.
3. Stable and sustainable increases in farming systems production in villages with a similar socio-agro-ecology to those in project clusters.

Immediate Objectives:

1. To take forward poverty-focused and participatory approaches to rain-fed farming systems development and generate greater awareness of those approaches in India.
2. To establish village-based institutions in project clusters that sustain the process of participatory agricultural development once the project is complete.
3. To identify priorities for natural resource development and income generation, and establish a detailed understanding of the farming systems and socio-economics of the project area.
4. To strengthen KRIBHCO's capacity to undertake agricultural and rural development activities and to collaborate with other institutions.

Source: (Jones et al., 1996: 7)

From the start the KRIBP envisaged promoting its research outputs and aiming to scale-up the benefits they could produce through institutionalising them within other organisations in India.

5.2.2 KRIBP Organisational Structure and Approach to Development

The KRIBP approach document provides a description of the targeted rural demographics and their farming agro-socio-economic situations (Jones et al., 1996: 6-11). At its inception, the KRIBP was located in a contiguous region consisting of three districts, one in each of the states of Gujarat (Panchmahals), Rajasthan (Banswara) and Madhya Pradesh (MP) (Jhabua)[30]. 65 to 85% of the population in the project area come from the *Bhil* community, a scheduled tribal (*adivāsi*) people. In this account of the project area specific attention was drawn to problems constructed from a combination of these factors, including: soil and water conservation, deforestation, low levels of farming system productivity, and general indebtedness (*Ibid*.).

Initially Krishak Bharati Cooperative Limited (KRIBHCO), an Indian multi-state cooperative society, was engaged as the implementing organisation for the project[31]. According to Mosse (2005: 25), one of a team of expatriate consultants on the project, KRIBHCO was chosen by the ODA on the basis of its large national reach which dwarfed anything any NGO could offer, and its relative independence from government institutions and their bureaucracy. Moreover, it was essentially a blank sheet onto which the new and in vogue participatory development agenda could be written with the aid of a team of consultants familiar with its principles and methods (*Ibid.*).

In order to manage the project separately from its other activities, KRIBHCO set up a Project Management Unit (PMU) that acted semi-autonomously from its other activities. The PMU was based in Dahod, Gujarat, and was headed by a Project Manager who was seconded from KRIBHCO middle management. Jones *et al*. (1996:18) summarised the project structure as follows:

> "The Project Manager heads a team comprising a Field Coordinator ... Field specialists (in crop agriculture, animal husbandry, agro-forestry, soil and water conservation, social science and community development), Community Organisers and support staff. He is supported by part-time consultants, who will be nationally recruited specialists in key disciplines. The Field Specialists provide back-up to the village based Community Organisers and will liaise with relevant government departments and research projects. The Community Development specialist will also maintain close links with NGOs. The Project Manager Reports to a Chief Manager in the Marketing Division in New Delhi

[30] On the formation of the KRIBP-E (EIRFP), this initial project area would become KRIBP-W (WIRFP).
[31] KRIBHCO principally manufactures urea fertiliser but is also involved in the production of other fertilisers and seed multiplication of mainly public-sector derived hybrid varieties. KRIBHCO operates a number of marketing networks for the dissemination and sale of its manufactured products.

> and is accountable to a Project Steering Committee (PSC), which has responsibility for formulating policy, agreeing strategic and operational plans, approving key staff appointments and reviewing progress. The PSC is chaired by the Managing Director of KRIBHCO and includes representatives of the Government of India and ODA."

The project area was divided up into 'clusters' of approximately six villages, each cluster was also selected to represent different agro-ecological and socio-economic conditions in the area and linked to poverty indicators (GVT, 2001c). The villages in each cluster tended to be grouped together within the same micro-watershed, had no electricity or surfaced roads serving it, and were generally located at least 5km from the nearest bus or rail link (Jones et al., 1996: 12).

Although KRIBHCO was the project implementing organisation running day-to-day activities, the ODA and the KRIBP project document called for a team of UK-based consultants to act as technical advisers, helping to steer the project design and implement its form of policy vision. The role for technical consultants was put out to competitive tender and was won for the first phase by a joint-bid put forward by a team from the University of Wales. The multidisciplinary consultant team was split between social scientists and economists who came from the Centre for Development Studies, Swansea, and natural scientists who came from Bangor. Initially there were between 8-10 consultants at the start of the project; some of the core team were as follows (Mosse, 1994)[32]:

- Steve Jones – Consultancy Team Leader
- David Mosse – Social Development, Participation, Local Institutions
- Mona Mehta – Gender issues
- John Witcombe – Crops (PCI)
- Dave Harris – Agronomy and seed priming
- Paul Smith – Watersheds and Soil and Water Conservation (SWC)
- Peter Bezkorowajnyj – Trees and agroforestry

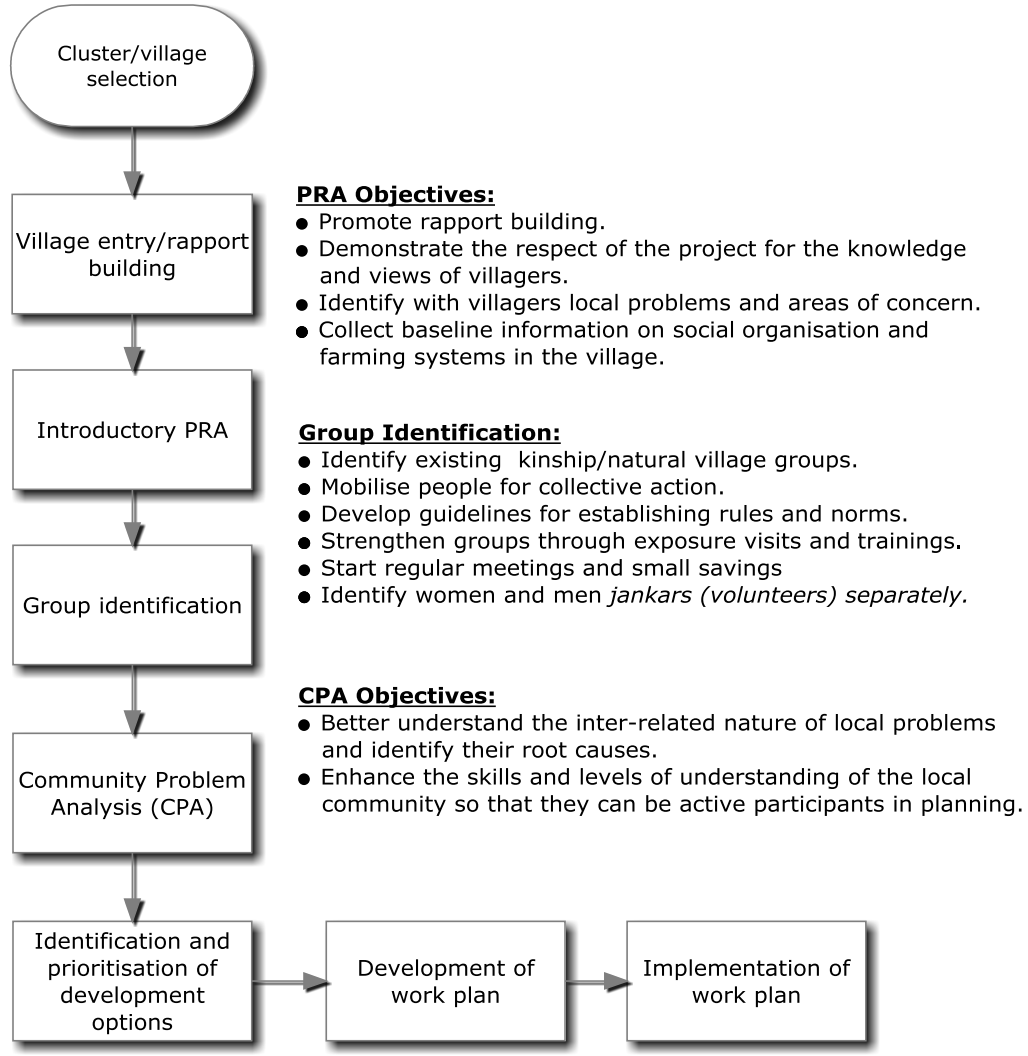
The funding for the technical consultancy roles was built into the project from the start. Each of the individual disciplines within the project, such as the crops programme, worked within nominal basic budget lines that had been predetermined and laid down in the initial project documentation[33]. The predetermination of budgets, the selection of villages, and the outlining

[32] John Witcombe Interview, Bangor, 9th October2012
[33] John Witcombe Interview, Bangor, 9th October2012

of key objectives and indicators of success in the log frame provided the initial boundaries within which the crop programme would have to work.

As a 'process' project the KRIBP aimed to help potential project beneficiaries by involving them in the planning and implementation of the project. KRIBP and WIRFP both used a participatory planning approach (PPA) to inform and generate their livelihood interventions. Figure 11 illustrates the PPA approach and some of the objectives of key stages.

Figure 11 - KRIBP Participatory Planning Approach



Source: Adapted from (GVT, 2001c)

To begin with, project staff would enter a selected village with a view to establishing a rapport with its inhabitants. The aim of this was to inform villagers of the project aims, discuss their concerns and alleviate suspicion they might have regarding the project's intentions, and to see

whether they would like to participate. It was also an opportunity for staff to collect basic information on the village and lay the ground for carrying out a more detailed Participatory Rural Appraisal (PRA) in the future (GVT, 2001c). The objectives of the general PRA are outlined in Figure 11. PRA is an umbrella term covering different participatory methodologies that can be used in order to generate information on farming systems, natural resources and social structures[34] (*Cf*. Narayanasamy (2009) for evolution of PRA and its associated methods). On the basis of the initial general PRA, socio-economic groups would be identified within the village which would then be used as for different Community Problem Analyses (CPAs).

KRIBP used the CPA as an extension of the PRA in order to better understand livelihood and farming system problems and their often complex origins. Essentially it consisted of working with different groups to identify general problems and then follow their causal dependencies to more specific problems or issues eventually resulting in the proposal of specific development options and solutions to target the constructed problems. On the basis of the CPA process, development options were worked out with priority usually given to solving problems that could be addressed quickly, with low cost to the project, low risk, and which encouraged collective action. The idea was to instil confidence in the project while allowing longer term development options to be planned and built into a longer term work plan. Smith (2001) saw experimentation with new crop varieties (PVS) as an early confidence building activity that did not require complex group action. Work plans consisted of a calendar of activities that took into account the heterogeneity of a village's social and gender structure so as to target and prioritise the poorest while also providing opportunities for involvement for other groups within the village. The plans also stipulated the degree of resource planning and sharing of costs and responsibilities between village groups and the project. As the situation changed in the village subsequent CPA sessions and work plans would be collectively devised, and further Issue Focused PRAs (IF-PRAs) would be carried out to obtain a better picture on socio-technical issues.

The personnel tasked with implementing the PRAs and carrying out the rapport-building activities were the Community Organisers (COs). Each cluster was assigned a pair of COs, ideally a male and a female, who lived outside the villages in the local towns, and who

[34] Some PRA exercises mentioned in one project document (GVT, 2001d) include: Collection of village agro-ecological information – **natural resource map**; analysis of socio-economic information – **social map**; establish information on village historical events – **time line**; and establish information on cropping systems, trees and livestock – **farming system diagram / calendar / matrices**; and, exploration and prioritisation of livelihood options – **seasonality diagram**.

preferably had a social and natural science background. Other than carrying out the PRAs and monitoring and evaluation (M&E) activities, COs were initially tasked with focusing their efforts on social development and village institution building, although they would later become responsible for other roles such as handing out payments, SWC work and organising crop trials. Smith (2001) suggested that these extra roles might have impacted adversely on the capacity of COs to carry out their social development tasks.

After the initial PRAs, the COs aided villagers in setting up Self-Help Groups (SHGs) in order to carry out further CPAs and more specialised IF-PRAs. There may be several different SHGs in any one village, and each SHG may nominate a number of *jankars*, who are fully accountable to them, and who will aid and organise the SHGs in carrying out different activities[35]. KRIBP staff sensitised *jankars* to different issues and trained them to perform a variety of different activities depending on the specific and general needs of the SHG. These included trainings on technical issues (SWC, post-harvest methods, crops, etc.); social issues (conflict management, working in groups etc.); and, working with other SHGs and communities, the project and Government, *inter alia* (GVT, 2001a). The *jankars* provided local on-the-ground staffing capacity for the project to see through each SHG's working plan. It was hoped that the *jankars* would provide services at a broader cluster level "... as autonomous, self-employed agricultural service providers and village animators, once the project is completed (Jones et al., 1996: 14)." It was hoped that they would eventually provide a means of sustaining the overall project impact in their locales, and that they would be self-sufficient as they received no salary from the project.

As a project steeped in the ethos of 'participation', it was only natural for it to be monitored and evaluated using Participatory Monitoring & Evaluation (PME) techniques (GVT, 2001b). The KRIBP featured different project administrative levels ranging from the SHG/village level, cluster, state, project and head office levels (*Cf*. GVT (2001c)). At the SHG level *jankars* were responsible for recording and collating information on the various SHG work plans. This was then collected by the COs at the cluster level who would provide monthly progress reports for the cluster. In each of the three states a monitoring cell comprised of multidisciplinary

[35] According to a project document (GVT, 2001a), "A *Jankar* is a paraprofessional, a female or male member of the community, who serves as an internal catalyst, information bank, service provider, trainer, knowledge disseminator and innovator. The *Jankar* provides help to a village group in monitoring and acts as a link between Government or any extension agency and community. Trained male and female *Jankars* have been instrumental in facilitating both planning, implementing and monitoring activities within communities."

specialists whose job was to consolidate, monitor and send analysis reports to the PMU while also relaying information back to the cluster level. At the project level the PMU was responsible for further consolidating the information coming from the state level, producing reports and sharing them with invested parties such as KRIBHCO, DFID, GoI and other NGO partners. Review PRAs were carried out two to three years after the start of the project to review progress made on the work plans.

5.2.3 KRIBP Crops Programme

The development of PCI methods and their use in the KRIBP project came about through the involvement of John Witcombe as the technical lead on the crops programme. A generalised account of the experience of being a consultant for the project's first phase is elaborated in a book by David Mosse (2005: 132-135). Box 3 contains the story of how Witcombe came to work on the KRIBP including his first exposure to participatory methods in plant breeding.

The technical consultants inhabited a privileged position within the project, outside of its day-to-day running and management, but able to strongly influence and direct its activities. According to Mosse:

> *"Consultants mediate at the interface between project operations and donor policy, interpreting each to the other. In relation to the project, they are outside experts expected to clarify policy, to train, demonstrate or guide staff in advancing specific programmes. In relation to the donor, 'insider' consultants establish significance, deliver expert judgement and report progress. Over time, as a project progresses, a consultant's power decreases in relation to a project, but increases in relation to the donor. Consultants have great influence over new projects derived from their ability to interpret donor policy and to formulate legitimate strategies and approaches; but this influence declines as project routines become established and take over. Correspondingly, the influence of consultants in relation to the donor increases along with their capacity to interpret increasingly complex and illegible project practice for distant donor advisers."* (Mosse, 2005: 134-135)

Box 3 - Biography of Prof. Witcombe leading up to his Involvement in KRIBP and the PSP

Prof. John Witcombe has been a central architect in the developing and advocating of PCI, PPB and PVS in crop improvement. Prior to the start of his PCI work he was a lecturer in genetics and plant breeding at the University of Wales in Bangor. During this time he led three germplasm collecting expeditions to India, Pakistan and Nepal. Between 1969 and 1984 he worked for the International Board for Plant Genetic Resources (now IPGRI) and was based at ICARDA in the Middle East.

In 1984 he left IPGRI to join the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) in Hyderabad, India, as a principal pearl millet breeder. Prof. Witcombe recounted that, while at ICRISAT, he became increasingly frustrated that breeding activities were focused on negotiating the trial system rather than focusing on the crop traits farmers wanted and needed. He mentioned creating early maturing varieties that would fail in the trial system because they would not yield as much as later maturing varieties, and because all the other candidate varieties would be harvested at the same time, leaving his to be eaten by birds in the interim.

A turning point for his approach to plant breeding came when he read a report produced by Thomas Walker, a socio-economist at ICRISAT. The report was based on a survey of farmers in Maharashtra linking the popularity of a particular variety of pearl millet to its early maturation and large (bold) grain size. Witcombe subsequently based all his breeding activities around these criteria creating a hugely popular variety that has been the basis of many spin-off varieties that have been adopted in seven countries across Africa and in India. He described his work as the "most successful breeding programme in pearl millet that ICRISAT has ever had" (Witcombe Interview). Reflecting on his activities he saw this work as being 'participatory', with respect to orienting his research to farmers' needs, albeit without talking to the farmers directly.

In 1990 while at a conference in Egypt, Witcombe was approached by Prof. Gareth Wyn-Jones with an offer for a job at the Centre for Arid Zone Studies (CAZS) at the University of Wales. Prof. Wyn-Jones was keen to put forward a bid to manage DFID's Plant Sciences Research Programme (PSP) and asked whether Witcombe would add his name and CV to the bid. CAZS-NR won the bid for the PSP and coincidentally at the same time, in collaboration with the University of Swansea, won the bid to be consultants on the KRIBP.

Prior to leaving to join CAZS in 1990, Witcombe knew that he would be involved as a consultant for KRIBP and manage the PSP. During this period Robert Chambers visited ICRISAT to speak with their socio-economists and, due to his general interest in social science and friendship with Walker, Witcombe met with him. He used this opportunity to discuss his ideas of FPR, formulated around his experiences of plant breeding at ICRISAT. In turn he was also exposed by Chambers to various participatory methods such as PRAs, farm walks and PVS that were going to be used in the forthcoming KRIBP (*Cf. Farmer First* narratives as outlined in the literature review)

At the beginning of the project Witcombe worked closely with Mr. Arun Joshi, the KRIBHCO crops field specialist, and Mr. Prabjhot Sodhi, the KRIBP project manager, to better understand the farming systems found within the project area. According to Joshi, prior to the start of the project (1992-92) they all worked together in a broad project formulation team of consultants and KRIBHCO staff, and carried out a large number of Rapid Rural Appraisals (RRAs) across the project area[36,37]. The RRAs helped the consultants and project staff better understand the farming systems and livelihoods of the tribal villagers, and how best to use participatory methods for beneficial development interventions.

As an accomplished plant breeder Witcombe was in a position to turn his skills and knowledge in crop science to addressing problems faced by *Bhil* farmers in their farming systems. As a plant breeder Witcombe would have suggested the use of a PVS-based intervention based on the then newly published experiences in *Farmer First* (Ashby et al., 1989, Maurya, 1989) and Louise Sperling's work on farmer varietal selection of beans in Africa (Sperling et al., 1993a)[38]. Box 4 contains a description of the rationale behind PVS and how it was implemented in the KRIBP and WIRFP.

[36] Arun Joshi Interview, Ratlam, 8th March 2011

[37] RRAs were the methodological forerunner to the PRA and consist of a streamlined and less developed set of methodologies than the PRA. RRAs are a quick and flexible means of generating information but in their initial user were predominantly extractive in nature and were not used to empower the people who were being appraised (Narayanasamy,2009 : 16).

[38] John Witcombe Interview, Bangor, 9th October2012

Box 4 - PVS as used in KRIBP/WIRFP

PVS has been at the heart of the KRIBP/WIRFP initiatives to help farmers improve their farming systems, livelihoods and reduce hunger. The PVS approach rests upon two key assumptions: that new cultivars are not adopted by farmers because of inefficient varietal promotion; and, poor adoption of new cultivars is not due to a general unwillingness to adopt or lack of a good choice of materials (GVT, 2001b). These assumptions are a direct critique of the formal public R&E system and point to a narrative, and potentially improved mechanism, by which farmers can gain access to and adopt appropriate new cultivars and plant material.

In PVS the criteria of varietal appropriateness is determined by farmers, but it is the project staff who then search and find a 'basket of choices' from which farmers can choose and evaluate. Farmers then have the option of adopting a number of varieties rather than the more limited number that are recommended for their region by the state. Since the testing of the new varieties was done by farmers, in their fields, and under their own management conditions, KRIBP thought these farmer-preferred traits and GxExM conditions were likely to mirror those of other farmers nearby, thereby facilitating the rapid and easy adoption of the farmer-approved varieties.

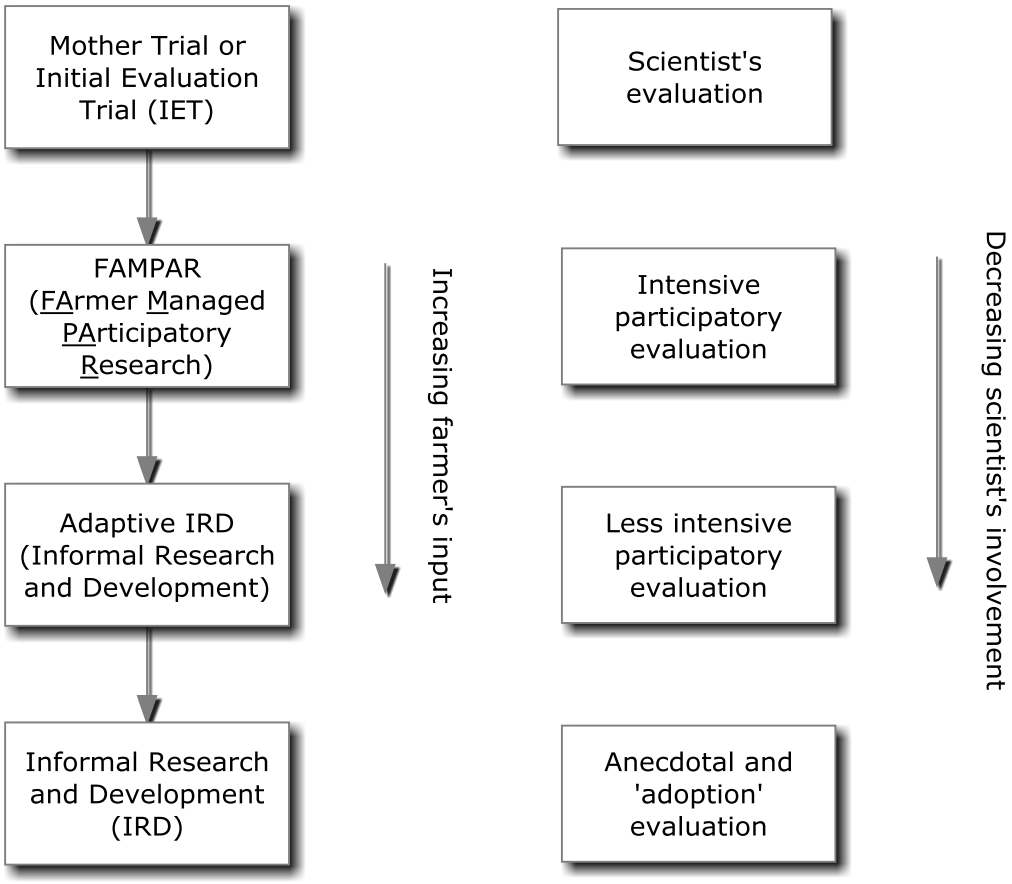
The general process of PVS, as employed by KRIBP and the WIRFP, is as follows:

1. Identification of farmers' needs in a cultivar:
    a. General PRA
    b. IF-PRA including Focus Group Discussions (FGDs) on crops
2. Search for suitable material to test among farmers from the following sources:
    a. Breeders' advanced lines
    b. Cultivars in an advanced stage of testing, including failed entries.
    c. Private sector releases
    d. State releases
    e. National releases
3. Experimentation and testing of new material with farmers on the basis of its acceptability
4. Wider dissemination of farmer-preferred cultivars

Under the KRIBP/WIRFP, stage 3 has been carried out in a number of ways involving a shifting ratio of scientist to farmer input depending on the context and rationale for the tests (See Figure 16). PVS when being used to evaluate the performance of potential varieties consists of a 'Mother' and 'Baby' trials. The 'Mother' trial is a single replicate design hosting many entries grown together in the same field. The Mother trials were also known as Initial Evaluation Trials (EVTs) since many varieties could be compared and short-listed for testing by farmers in FAMPAR (baby) trials in the following year. The central mother trials acted as a focal point to discuss the potential new varieties and they could also be constructed to provide quantitative analysable data on yield, *inter alia*. This data is essential with respect to presenting data of the trials to the wider scientific community and in supporting new candidate varieties in the state release process.

FAMPAR trials were conducted by farmers on their land and under their management conditions. FAMPAR trials compared one new variety against the farmer's local landrace in adjacent plots. The trials were evaluated in a participatory mode, using mainly qualitative methods, or project staff could generate quantitative yield data in collaboration with farmers (GVT, 2001b). Finally, wider dissemination of the farmer-preferred varieties could be carried out through IRD and adaptive IRD (between IRD and FAMPAR) which were similar to the FAMPAR trials but which forwent monitoring and evaluation in favour of promoting the farmer-approved varieties among as many farmers as possible.

Figure 12 - Different PVS Formats Employed by KRIBP and GVT



Source: *Adapted from (GVT, 2001b)*

Under the CPA phase of village engagement COs would discuss general problems with the various SHGs, leading to a co-definition of more specific problems and potential ways to address them. One of these chains of problem definition and solutions is recorded as follows (GVT, 2001c):

Not enough food. *Why?* Low agricultural productivity. *Why?* Crop varieties inappropriate → PVS/PPB

Other factors such as lack of money, low soil fertility, and a lack of irrigation were also recorded for the general problem of 'not enough food' (GVT,2001d). These factors could in turn be traced to other project interventions such as Soil Water Conservation methods, giving

rise to the consultant Mosse's critique (2005:91-95) on the power of consultants to set the project agenda and type of intervention[39].

The initial RRAs and PRAs that were carried out by the project formulation team prior to the project's commencement generated a large compendium of information on the project area that, when combined with a voluminous secondary data-mined document, would form the basis of the future research and development agenda for the project[40]. From this initial work it became apparent to the crops team that with respect to improving Bhil farming systems and food security, raising the productivity of their principle staple crops was their major concern. The crops of greatest importance identified at this stage were maize, upland rice and certain pulses.

PVS as an activity is more than the evaluation of different plant types by farmers. In order for it to be successful, appropriate varieties need to be chosen to test with farmers, and the correct amount of seed is needed for the trials and dissemination (See Box 4). With information derived from the initial PRAs, project staff could start the search for appropriate varieties for farmers to select. In a consultancy visit in January 1992 Paul Smith and John Witcombe began a search for appropriate rice and maize varieties by visiting some SAUs and their research stations in the project area, as well as other national research institutions[41]. Although the meetings with scientists were largely based around the search for appropriate varieties, the consultants also gained basic but valuable insights into the Indian research system, such as how scientific on-farm testing was carried out, and that there was technically no legislative barrier to releasing varieties produced through farmer participation. Moreover, there were some positive interactions with plant breeders from RAU who were keen to visit the project villages, while others offered to multiply breeder's seed of particular varieties if invoices (indents) were provided in time. The two consultants also provided an in-depth IF-

[39] Mosse's *ex-post* critique of the first phase of the project is recorded in his "Cultivating Diversity" book. The book is considered divisive by some of his previous colleagues on the project. Some consider it as overly critical, professionally damaging, and/or disagree strongly with some of the issues he raises. The view taken within this thesis is that the book yields an interesting critique on the power relationships between stakeholders of participatory development projects, particularly in the context of KRIBP. With respect to the PVS/PPB elements of the project he is less scathing describing them as being less contextually embedded than other project interventions within individual villages, such as SWC work, and with advantages that could be better generalised across the project (Mosse, 2005:140).

[40] Arun Joshi Interview, Ratlam, 8th March 2011

[41] The consultancy visit was divided between meeting plant breeders and scientists involved in maize and rice research. The organisations visited for rice were University of Narendra Nagar, UP; Rajasthan Agricultural University (RAU) Banswara and Udaipur; Central Rice Research Station, Nawagam, Gujurat; IARI; and JNKVV, Jabalpur, MP. The organisations visited for maize were GB Pantnagar University, UP; RAU Banswara and Udaipur and JNKVV Chhindwara Research Station, MP.

PRA for COs to carry out with farmers in order to identify agronomic practices, farming problems, market prices and preferences, and desired crop traits - which would be used to inform future research priorities.

After the initial PRAs Arun Joshi recalled that in September 1992 there was a period when the GoMP mounted a campaign for improving winter (*rabi*) crops, which was predominantly wheat and chickpea in the project area[42]. The project was approached by a government collector who advocated the use of minikits consisting of a recommended package of seed, inputs and practices, which ran contrary to the project's participatory approach. It was at this time that that the project began carrying out farmer participatory trials on five chickpea varieties. The chickpea trials followed on from the summer (*kharif*) trials on four maize and four rice varieties, which collectively marked the start of farmer varietal evaluation trials on the project. In December 1992, John Witcombe visited and observed the preliminary *ad hoc* farmer-managed participatory trials and provided direction in improving their structuring and making them more scientifically rigorous[43]. Although the focus of the crops section in 1992 had been on maize and rice, other crops had been identified by the consultant as being important to *Bhil* farmers, such as hybrid cotton[44], pigeon pea, chickpea, safflower, black gram, sorghum and niger.

The initial search for appropriate maize varieties from official sources yielded mixed results. Although contact was made with scientists at SAUs and at other research institutes, the varieties that scientists recommended for the project area were not similar to the traits that the project farmers needed. The PRAs had shown that the type of maize variety farmers wanted was Open Pollinated Varieties (OPVs), synthetics rather than hybrids, white endosperm (grain) colour, flintiness (hard seed), shorter duration growing season (75-80 days to avoid terminal drought), low fertiliser response, and medium tall (for fodder). These qualities were only partially present in the varieties recommended by plant breeders for the project area, and this was further compounded by a dearth of white grained maize varieties. The lack of appropriate varieties to test with farmers, prompted Joshi and Witcombe to consider carrying out plant breeding *research*, which had not initially been within the project plan. Joshi recalled that there was initial resistance within KRIBHCO and the ODA to doing crop research since it was not within the mandate of the development project and ran the risk of

[42] Arun Joshi Interview, Ratlam, 8th March 2011
[43] John Witcombe Interview, Bangor, 9th October2012
[44] Hybrid cotton was never picked up by KRIBP, but was justified by the consultant on the basis of the success of an Aga Khan project in which it featured.

getting "bogged down"; however, they made the case for plant breeding research to their seniors on the basis that they would not have anything appropriate to offer farmers were they not to do it[45].

With the case for plant breeding activities having been accepted, a modest maize breeding initiative was started on 1 Ha of rented land, close to the project HQ in Dahod, Gujarat. Since the consultants were based in the UK the initial plant breeding crossing work scheduled for 1993 *kharif* season was to be carried out by Arun Joshi, with the help of Praveen Ghotkar, and Narendra Bhadoriya, other crops specialists. None of the project staff had plant breeding experience but were still able to do a good job in generating the composite population, having been left instructions by John Witcombe[46].

The project then had a fledgling maize breeding programme on land in the project area which soon became known within the project as the Dahod Research Farm (DRF). However, plant breeding is a more involved process than carrying out varietal trials and although Witcombe's consultancy visits were regular and seasonal, they were also short with full and ambitious itineraries[47]. In order for the breeding programme to address the experience and manpower constraints, the project would have to work more closely with the formal research system. By then the consultant and project staff had made contact with plant breeders and researchers at SAUs and other research institutions in their bid to find appropriate plant varieties to test with farmers, but these relationships would have to be strengthened and formalised in order for SAU staff to carry out more collaborative plant breeding work.

Strengthening the relationships between KRIBP and public plant breeding organisations was seldom easy. Part of this exercise depended on exposing plant breeding researchers to the potential benefits of the participatory mode of research, which due to its relative novelty, had not been reported much in the literature. As mentioned earlier, during the 1992 PVS trials RAU rice breeders expressed interest in visiting the PVS trials to see how their recommended varieties performed in farmers' fields. Witcombe recalled that, "(it) was quite an eye-opener because they basically knew what the results would be, and they didn't really want to come to the field and see it. Because they were recommending for the drylands dwarf varieties – and

[45] Arun Joshi Interview, Ratlam, 8th March 2011
[46] John Witcombe Aide Memoire Sept-Oct 1993
[47] The regularity of his visits varied but there were usually two visits per year with more towards the start of the project. Project visits were short, in the region of one to two weeks, and were formulated around a terms of reference which meant that meetings were pre-planned.

they absolutely fail, and I think they knew that and didn't want to see it."[48] Visits such as these could backfire when scientists were confronted with the inadequacy of the recommendations they were making for rain-fed areas by an outside interloping organisation.

The receptivity of agricultural scientists to PCI differed depending on the individual, and this inevitably affected the ability of the KRIBP to form relationships with SAUs. Interested scientists could provide further useful contacts, broker meetings and volunteer their time and knowledge. Others adopting the traditional plant breeding ethos sometimes feigned interest in the project describing it as "Very innovative!", but remained unconvinced of the approach and its narrative critique of mainstream plant breeding research[49]. Witcombe believed that winning over scientists and policy makers with evidence of the efficacy of PCI methods was important in the project's mission to engage with the specific and wider research community. During the first phase of the project there were two major initiatives which sought to provide more evidence for the narratives supporting the rationale for PCI[50]. The first initiative, outlined in Box 5, describes a project funded by DFID's RNRRS, separate from KRIBP and the PSP, but known to it as the Regulatory Framework Project.

[48] John Witcombe Interview, Bangor, 9th October 2012
[49] John Witcombe Interview, Bangor, 9th October 2012
[50] During WIRFP phase I PCI was in its nascence.

Box 5 - The Regulatory Framework Project Box and "Seeds of Choice" Book

The Regulatory Framework Project as it was known in KRIBP was part of an ODA-funded project titled, "Small Farmer Seed Supply: Reforming regulatory frameworks for testing, release and dissemination." The funding for the project came from the Central Research Department, now known as the Research and Evidence Division, and was a collaboration between the ODI, DFID and the University of Wales (CAZS-NR). The following synopsis of the project was sourced directly from DFIDs website and provides the project's rationale (DFID, 2012).

Start Date: 01-04-1994
End Date: 30-09-1996
Total Cost: £365,000
Project Code R5950ca

Objectives:
To provide guidelines, principles and options on seed regulatory reform to policy makers and donors involved in the formulation of national seed policy.

Background:
In many developing countries, new seeds produced by breeders are subject to lengthy and expensive screening to ensure that they conform to official criteria for release. This process, frequently based on N. American or European models, is governed by a complex set of national legislation, scientific guidelines, norms and standard practices termed here regulatory framework. There are some justifications for these approaches, including the need for standard testing procedures, for evidence that new varieties will perform well under a range of conditions, for systematic data on which to base extension recommendations, and for a standard set of criteria against which such data can be obtained. However, in the light of growing awareness of low-income farmers' capacity to identify and select genetic material to suit the diverse agro-ecological and socio-economic niches in which they seek livelihoods, such advantages may be outweighed by the fact that such costly testing procedures severely restrict the basket of choices that scientists can offer to farmers and systematically bias the characteristics of released varieties towards the needs of better-off farmers.

Intended Outputs:
- Country papers outlining strengths and weaknesses of regulatory frameworks.
- Methods for statistical and economic analysis of breeding data.
- Concise guidelines for the management of regulatory reform.
- Workshop proceedings.
- India workshop.

Progress and Impact:
The project produced the most comprehensive and in-depth review of the conduct of national seed regulation available. It identified a set of problems that affect the management of variety testing, variety regulation, and seed quality control; and produced a review of experience and guidelines for future action regarding options for regulatory reform.

Project Conclusions:
The issues that the project addressed involve significant changes in national seed policy, experimentation with new organisational forms of variety selection and seed production, and fundamental institutional reorientation. This type of change will not take place overnight. There is a need for sustained discussion and debate within particular countries in order to stimulate new initiatives. The efforts that project personnel have undertaken in India, in both formal and informal meetings, provide an example of the type of activity that is required to promote seed regulatory reform. It is important to emphasise that seed regulatory reform will not be brought about by a series of sweeping changes in national laws, but rather by sustained and committed debate and comprehensive acknowledgement of the interests of all stakeholders in national seed systems. The structure of these debates and discussions will vary from country to country, but project experience and documentation will form a valuable basis for any seed policy analysis. The documentation and the dialogue initiated by the project can be expected to play a significant role in future policy debates. The project provides the most comprehensive and up-to-date review of issues related to seed regulatory reform available anywhere. The project documents clearly outline the problems that national seed regulatory systems must address, describe realistic options, and provide guidance on the implications of any particular regulatory choice.

The Regulatory Framework Project generated two important books on seed regulatory reform: 'New Seeds and Old Laws' on global regulatory reform and the diversification of national seed systems; and 'Seeds of Choice' on the regulatory framework governing seeds and varietal testing in India (Tripp, 1997, Witcombe et al., 1998). The latter book involved John Witcombe as well as other KRIBP staff, and the project commissioned terms of reference for consultants to investigate national and state (MP, Gujarat and Rajasthan)[51]. Moreover, the book provided further information on the extent and rate of adoption of modern cultivars in India; how well the AICRP testing sites represent AEZs and farmers fields; and resource allocation and efficiency of the varietal testing system (Witcombe et al., 1998). The book also contains a section on how PCI methods and NGOs can play a part in varietal popularisation, in line with the experiences of the KRIBP project (*Ibid*.). Collectively the chapters represent a strong critique of the AICRP and varietal testing and release system, and further bolstered the arguments in favour of PCI.

As part of this project a joint ICAR-ODA workshop was held in Hyderabad in September 1995, and efforts were made by its consultants to take their findings and suggestions of reform to the top of ICAR. Prior to the publishing of Seeds of Choice, Dr. Mangla Rai, an ADG at the time but who would later become the Director General, Dr. S.P. Tiwari (ADG Crop Science), and project directors from various AICRPs were also invited to a meeting in London convened by the ODI[52]. The purpose of the visit was to convince ICAR to publish the book and that it was based on rational analysis, supported by data, and was not a polemic (*Ibid*.). The consultants hoped that if ICAR accepted and adopted the research findings, they would have a greater chance of being addressed and potentially mainstreamed with a view to altering policy (*Ibid*.).

In the event, ICAR would not endorse or publish the book and Witcombe has argued that the project's aspiration was "dramatically overoptimistic", although he thinks that the book has been noted and is quoted by staff within ICAR even though it has not directly changed policy regarding varietal testing and release[53]. One tentative reason for why the regulatory framework critique did not find traction within ICAR at the time was that the AICRP programmes were simultaneously being reviewed, the outcome of which favoured the

[51] One of the consultants Bhasker Raj had previously worked with Witcombe at ICRISAT, and both Andrew Packwood and Daljit Virk would continue to work in collaboration with Witcombe in the future on PSP related projects. Daljit Virk would later become the consultant for KRIBP(E)/EIRFP and other related projects and is still with CAZS-NR in 2012.
[52] John Witcombe Interview, Bangor, 9th October 2012
[53] John Witcombe Interview, Bangor, 9th October 2012

retention of the existing system of varietal testing and release[54]. Since *Seeds of Choice* was an external critique of their system it may have fallen prey to the 'not-invented-here bias', and sidelined in favour of ICARs internal review; although without the ICAR internal report it is not possible to truly understand the reason for its rejection. Alongside the regulatory framework's initiatives to effect policy change at a national level, KRIBP staff arranged to fund a two day workshop at GAU and another workshop at RAU to discuss the results of the project.

A subsequent initiative undertaken by KRIBP was the creation of an Indian Cultivar Database (Smith et al., 1999). The need for a cultivar database came from the initial searches for appropriate varieties that had to be carried out in order to start PVS activities. Trawling for information on appropriate varieties led Witcombe and colleagues on long trips to disparate organisations since much of the information was not electronic and existed only in grey literature format. Furthermore, individual states did not communicate with each other on the release of varieties that could be of use in similar ACZs in other states. In 1999, the database contained information on 1634 varieties divided between 15 crop species, and KRIBP planned that it would be maintained by KRIBHCO and ICAR institutes for the second phase of the project. Smith, who was principally involved in this project, took the database to an ICAR institute and received a hostile reception when he presented them with the concept, particularly around where KRIBP had sourced the information, saying that it was copyright even though it was in the public domain[55].

The second major initiative again rose from outside of the KRIBP, but involved it, and was also aimed in part at strengthening the PCI narrative through carrying out PCI research in High Potential Production Systems (HPPS). As a manager of DFIDs RNRRS PSP, Witcombe was in a position to support research projects congruent to the aims of the programme (*Cf*. Stirling *et al*. (2006) for an *ex-post* review of the activities and achievements of the PSP).

In 1994, during the first phase of KRIBP, the RNRRS underwent a review which stipulated that the RNRRS reorient itself to better consider 'end-users' in technology design and be more 'demand-led' (Stirling et al., 2006). As part of the review process there was an in-house consultancy exercise in which DFID staff in the field were asked to identify important natural research constraints that could feasibly be addressed through the RNRRS. Although this was a small and somewhat narrow consultation process, it helped to link DFID's centrally

[54] Daljit Virk Consultancy Report Nov/Dec 1995
[55] John Witcombe Interview, Bangor, 9th October 2012

coordinated and funded strategic research opportunities with its then current field-based development activities in the belief that this would improve its identification of uptake pathways for the products of research (*Ibid*.). With respect to the RNRRS PSP, the findings of the review gave support to the funding of PCI projects since these involved identifiable beneficiaries and uptake pathways.

Within the PSP, PCI projects made up 19% of the programmes total funding and were sometimes used to deliver technology derived from other research themes within the PSP (Stirling et al., 2006)[56]. Five of the PCI projects were carried out in HPPS (Project ref. R6748, R7112, R7323, R7542 and R8071). Of the five HPPS projects, two were carried out in India (Punjab and Gujarat), the others being based in Nepal and Bangladesh, and a variety of PCI methods were tested including PVS, IRD, PPB and agronomic practices such as seed priming. One of the main reasons for carrying out the HPPS work was to challenge two often confronted counter narratives to PCI encountered by practitioners within scientific research bureaucracies, specifically that:

- "High literacy levels, knowledge of opportunities, and agro-ecological homogeneity in HPPS make it easier to obtain information and opinions on farmers' practices, opportunities and constraints through conventional extension rather than by face-to-face PRA, and;
- A near-optimal use of genetic material and agronomic practices in HPPSs makes Participatory Research (PR) redundant." (Virk and Witcombe, 2000;1-2):

The outcomes of the HPPS projects were outlined in both internal and external M&E reports, as well as by peer review, collectively conferring a degree of legitimacy to the idea that PCI is useful in the context of HPPS (Witcombe et al., 2001). HPPS contributed to increasing crop specific richness (biodiversity) in farmers' fields, and often out-yielded the most popular local varieties (*Ibid*.). Although HPPS projects were carried out in different regions, the contradiction of the above two counter-narratives provided a supportive tool to consultants on the KRIBP trying to convince reticent scientists in the NARS of the utility of PCI methods in broader contexts. PCI was no longer just a method for addressing the technology needs of poor farmers in marginal environments but now provided some evidence that the NARS was

[56] The PSP research themes in order of ascending total programme expenditure are: downy-mildew resistance (7%); photothermal effects (7%); thermo tolerance (8%); salinity tolerance (9%); drought tolerance (11%); molecular markers (13%); PCI including seed priming (19%); and, Transgenics (26%).

not meeting all the needs of better-off farmers. Over its duration the PSP worked with many organisations and helped create an informal research network.

The managers of the PSP cite the network as having "greatly contributed to capacity building and facilitated the exchange of germplasm and ideas between partners", including KRIBP (Stirling et al., 2006: 141) Moreover, it allowed for the establishment of a network of PCI advocates who were practicing and developing participatory methodologies; creating peer reviewed articles; and sharing their experiences of working with different NARS and research institutes. This research network overlapped with the KRIBP project and allowed for information generated in different contexts, such as Nepal, to influence the KRIBP's crop division research agenda.

The regulatory framework project and HPPS work occurred in parallel to KRIBP but were commissioned by DFID/PSP in order to address the needs for regulatory information and strengthening of PCI narrative arising from the experiences of KRIBP staff early in the project. However, these two projects did not produce their outputs till later on in KRIBPs first phase so would not have been of use earlier in setting up, strengthening and formalising research linkages with SAUs and other research institutes.

With the setting up of the DRF and the commencement of maize breeding activities by KRIBP in 1993, there were a number of issues that were repeatedly reported on in the consultant's aide memoires of their visits. By 1993 the early experimental trials of PVS had met the consultant's expectations and KRIBP management sought to expand the number of crops and trials taking place[57].

One criticism raised by Witcombe at this stage was that COs were failing to correctly implement PVS despite the simplicity of the trial design (*Ibid*.)[58]. Although the COs responsible for the improper trials were corrected, this issue highlighted the problem of having non-subject matter specialists carrying out the trials. Moreover, COs were responsible not only for the crops programme but all the other project initiatives such as SWC, microfinance, forming village institutions, *inter alia*. An expanding crops programme placed more demands on the CO's time and also drew attention to the limitations of what they could achieve given their

[57] KRIBP Crops Annual Review 1993

[58] Trial design consisted of farmers growing a side-by-side comparison of the trial variety next to their normal variety within the same field to avoid local changes in microclimate and soil conditions.

various backgrounds and accumulating responsibilities. This prompted Witcombe to write about the need for an extra third appointment of a dedicated staff member to the crops programme to help with data collection, seed procurement, evaluation and general administration (*Ibid*.).

Initial less-formal interactions with SAUs had, in the beginning, appeared promising. Dr. Tripathi, a rice breeder at RAU research station Banswara had initially helped in identifying promising varieties and had expressed interest in collaborating with KRIBP. In 1993 Dr. Tripathi wrote and signed a letter of agreement to work with the project, however, Witcombe found later that the letter was not sufficient for collaborative research and that a Memorandum of Understanding (MOU) would have to be negotiated with RAU's Department of Research in order for collaboration between the project and the university to proceed[59]. MOUs are contractual agreements between the SAU and outside agencies, providing external funding for research, that stipulate the different responsibilities and broad activities of the different involved parties.

In 1993 the crops programme sought to set up initial MOUs with GAU and JNKVV on maize, and RAU on rice. The negotiation of the initial MOUs between project staff and the universities were an ongoing issue during the first phase of the project due to repeated stalling on the part of universities and a failure of KRIBP and SAUs to reach agreements. For example, Dr. Arha of the maize research station at Godhra (GAU) was reserved regarding the feasibility and necessity for participatory methodologies and suggested work on plant breeding work be carried out at another research station in Derol that did not have the necessary irrigation facilities for carrying out off-season breeding work. As part of their MOU negotiations the KRIBP crop programme stipulated the importance of a dedicated Research Associate (RA) to help implement and oversee the crop trials; however GAU wanted more money than the ICAR suggested RA salary, and a plant breeder at JNKVV highlighted the lack of personnel able to supervise an RA at Jhabua research station where the proposed maize testing and breeding activities were to take place.

These represent a few of the managerial and organisational issues within SAUs that both parties had to overcome in order to move forward into collaborative research. The first MOU was signed in 1994 with GAU on maize breeding and coincided with the retirement of Dr. Arha

[59] John Witcome Aide Memoire May, September/October 1993

and the appointment of Dr. Goyal, a plant breeder who seemed more enthused by the concept of farmer participation[60]. The other MOUs took longer to secure with the proposal for a JNKVV MOU on maize being dropped in favour of an "alternative strategy" with another plant breeder Dr. M. L. Tamar who was interested in oilseeds, niger and castor[61]. An MOU with RAU on rice was finally agreed, but collaboration was setback when a popular PVS rice variety Kalinga III was not discussed in the ZREAC to be put forward for release, despite this previously being agreed on by Witcombe and Dr. Tripathi. When Dr. Virk visited RAU in 1995, Dr. Tripathi was absent and he was told by another plant breeder that Kalinga III would have to go through the entire trial system from the beginning[62]. When the plant breeder was told that the variety had already been released under AICRP trials in Orissa, he reluctantly agreed that it could go before the ZREAC with the appropriate formal and FAMPAR data. When pressed on the reason for his reluctance, it materialised that Banswara had been promoting a rice variety, Vagad Dahn, that they had been breeding at the research station and which they thought was better than Kalinga III. Virk recorded in his Aide Memoire that the concerned breeder did not want to see *their* variety compete with one produced by scientists in Orissa, even though the latter Kalinga III variety had been proven earlier maturing and more popular in famers' fields under PVS[32] (*Cf*. Virk *et al*., (1996)). However, through the signing of the MOU with RAU, Kalinga III would eventually enter the state trials system and be recommended for release in Rajasthan. By the end of the first phase of KRIBP the following research linkages had been established with SAUs[63]:

- GAU – MOU relating to PPB in maize. On the basis of the success of the maize KRIBP proposed an MOU on rice, but this remained unsigned by the end of the first phase.
- RAU – MOU on rice, allowing for state release of Kalinga III.
- JNKVV – No MOUs were signed , but informal linkages allowed for the supply of unreleased varieties (advanced lines) of black gram and maize to be tested in the project.

KRIBP's limited success with formal collaboration with SAUs during the first phase had been resource and time consuming, and enhancing these linkages would form a major part of the crops programme's strategy in the second phase (*Ibid*.).

[60] KRIBP Crops Programme Annual Report 1994
[61] John Witcombe Aide Memoire February 1995
[62] Daljit Virk Aide Memoire Nov/December 1995
[63] KRIBP Project Document Report on Crops Programme 1992-1999

Other than enhancing its collaboration with the public sector, Witcombe and later Daljit Virk both stressed the importance of seed multiplication to the success of the crops programme. As the number of crop species, varieties tested and farmers increased during phase one, so did the project's demand for seeds. What initially started as small sample quantities of seed that were tested by the projects or collaborating SAUs, would later have to be scaled up for wider testing, and dissemination in terms of distribution and sale of seed to farmers and the private sector. In May 1993 Witcombe reported that the project's maize breeding programme was delayed due to the lack of good seed storage facilities in Dahod[64]. In a visit in October 1993 Witcombe suggested that the project consider purchasing 10ha of land for the DRF that could be used for seed multiplication as well as plant breeding, agro forestry and crop demonstrations, since it would make the project less dependent on the SAUs for seed multiplication. The request for more land at Dahod was repeated in 1994 and throughout 1995, in the consultant aide memoires, but the request does not feature again after 1996. The early mechanisms proposed for seed multiplication varied according to the material and quantities required:

- Where seed is not commercially available and only small quantities are to hand multiplication will be done by the project itself in Dahod (DRF).
- Where seed is not commercially available and large quantities are required for adaptive trials then KRIBHCO's commercial seed unit have been asked to undertake the multiplication of truthfully labelled certified seed.
- For commercially available seed, indents will be made to State or commercial organisations. Where such seed is in short supply KRIBHCO should also undertake multiplications.
- Where possible, the organisation responsible will supply us with seed, as has been done in the past by JNKVV for white grained maize.

In 1994 Witcombe produced a two to three year seed strategy for the KRIBP, outlining a number of options available to the project depending on the availability of seed[65]. He suggested providing 'seed indents' to SAUs and state seed corporations for released varieties as the simplest but least reliable as seed indents are not legally binding. Third party contracts with commercial farmers were an alternative to this, but were more complex to manage across multiple crops and farmers. A particular issue in seed supply was the case of those

[64] John Witcombe Aide Memoire May 1993
[65] John Witcombe Aide Memoire October 1994

varieties in which there were limited or non-existent supplies of seed. In this case his major recommendation was for KRIBHCO to set up an individual seed unit which the organisation seemed amenable to, although this would take time to set up and get running. In 1994 Witcombe did not want to pursue community-based seed production until more detailed information was known on how farmers procured seed in the villages[66]. He also suggested that farmer-to-farmer dissemination would likely be an important mechanism for dissemination and popularisation of varieties of certain crops, such as rice, chickpea and niger, but may prove problematic in the case of maize that would outbreed and lose its genetic purity after four years (*Ibid*.).

By May 1995 an agreement between KRIBP and KRIBHCO on the Seed Unit structure and processing plant had not been reached[67]. Witcombe discussed with Dr. Khare the importance of making the seed unit profitable in order to help the sustainability of the project[68]. Creating a profitable enterprise meant producing seed for varieties that had a broader appeal that could underwrite the project varieties. Khare and Witcombe considered rice varieties for irrigated areas but Witcombe stressed the importance of not just mimicking the old varieties recommended for release by the states – something which KRIBHCO management were currently pursuing. Witcombe also discussed the importance of extending the seed multiplication programme to MP and Rajasthan other than just in Gujarat.

By the end of 1995 the KRIBP Seed Unit had been established in Dahod, Gujarat. The Seed Unit had two large warehouses based in Dahod capable of processing and storing up to 15,000 t of grain. Due to KRIBHCO policy the Seed Unit only produced one quality grading of seed, certified seed, which was often of too high a quality needed for many of the PVS trials in the project[69]. In response, Joshi and Witcombe co-authored a Seed Policy Document containing a written argument in favour of Truthfully-Labelled Seed (TLS). The authors cited the following benefits for using TLS:

- The sale of TLS does not expose the vendor to more risk than certified seed were it to be inaccurately labelled.
- There may be little or no price premium for certified seed over TLS.

[66] John Witcombe Aide Memoire October 1994
[67] John Witcombe Aide Memoire May 1995
[68] Dr. J. Khare was an agronomist and General Manager of Marketing Services for KRIBHCO and was their main liaison with the project until his retirement in 1995.
[69] KRIBP Report on the Crops Programme 1992-1999

- The consequences of arbitrary decisions by certification authorities not to certify seed are avoided.
- Varieties that are not notified (released) can be sold.
- Delays caused by certification can be avoided.
- Production per hectare is not limited with TLS (arbitrary limits for certified seed raises seed production costs).
- Certification does not guarantee quality (proper seed multiplication technique does).

Despite the crop programme's insistence, KRIBHCO would still not allow for TLS to be multiplied by the Seed Unit at the end of first phase. By the end of the first phase five village-based seed producer and distribution groups were set up, one in Rajasthan, two in MP and two in Gujarat and some of these groups had started producing maize and chickpea seed in small quantities. Purchase of new seed within villages was dependent on the setting up of working credit groups in order for farmers to afford the new seed. At the end of the first phase the village-based seed producer groups were not fully functional.

Towards the end of the first phase the KRIBP crops programme had successfully started plant breeding activities and had forged some tentative working relationships with SAUs. In spite of these achievements, the expansion of the scope of the crops programme meant that it was becoming more reliant on outside organisations to aid it in delivering its vision of PCI – it did not have the in-house expertise, land and manpower. Although the crops programme had engaged in collaborative research with SAUs, it was still a long way from formalising and increasing these relationships and it was still being inhibited through being unable to produce enough seed.

5.3 The WIRFP Phase II (1999-2007)

By the end of the first phase the KRIBP crops programme had developed and honed its distinctive version of PVS and PPB methods; proven the concept of PCI and its ability deliver appropriate varieties for rain-fed and HPPS farming systems; and began to scale-up the dissemination of farmer-preferred throughout the project and wider afield via interested NGOs. Towards the end of the first phase the KRIBP crops programme drew up a document for their plans for the second phase[70].

The intended programme included (*Ibid*.):

- Renewing the formal linkages (MOUs) with the three SAUs in the project area to cover PVS and PPB in all major crops identified in the first phase (See Table 15).
- Replicating each crop MOU across at least two universities in order to:
    - Guard against institutional failure (particularly change of personnel at an SAU) and possible technical failure (unreliable results/drought).
    - Crop type differentiation between universities, e.g. yellow maize in Raj., white maize in Gujarat and MP.
    - Release of potential varieties is restricted by state for state varietal trials and the performance and release of varieties in state and national trials is not guaranteed. MOUs with SAUs in multiple states increase the probability that farmer-preferred varieties get released and have greater coverage.
    - Different programmes can use contrasting parental material which will increase the probability that at least one will succeed.
    - Selection environments for the breeding programmes will differ across the states resulting in local adaptation.
- Improving linkages with any ICAR institutes that are doing research on crops that meet the needs of poor farmers. This includes crop directorates in maize, rice soybean etc.
- Enhancing linkages with other DFID RNRRS projects including the PSP, Crop Post-Harvest Programme and Crop Protection Programme.

The projected activities in the list above précis the issues that arose during the first phase, in particular regarding the issues of working with the various SAUs, and presents a desire to scale-up the PVS/PPB activities which had been piloted thus far (Table 15). It is notable that

[70] KRIBP Crops Programme (1998) – Research for Development Activities in Phase II

the planning document did not explicitly mention seed production and dissemination activities at this stage.

Table 15 - SAU Linkages at the end of KRIBP Phase 1 and Projected for Phase 2

Crop	RAU	GAU	JNKVV	Objectives
Maize	X	**X†**	**X‡**	Improved grain quality and yield. Variety cross hybrids.
Rice	**X**	**X**	X	Diversification away from Kalinga III for upland rice.
Black gram			**X**	Combining high yield, powdery mildew resistance and grain quality with appropriate maturity.
Chickpea	X	X	**X**	Improved pest resistance in collaboration with ICRISAT.
Horse gram	X		**X**	Earlier duration. Improved grain quality (colour and size). Determinate habit.
Sunn hemp			X	Earlier duration. Fodder quality.
Niger			**X**	Earlier duration. Determinate habit. Non-shattering inflorescences.
Pigeonpea			**X**	Pest and wilt resistant varieties with preferred grain colour in a range of duration in collaboration with ICRISAT.

Source: *KRIBP Crops Programme (1998) – Research for Development Activities in Phase II (Unpublished)*

Key: *† bold underlined font indicates an MOU has been signed in Phase 1*
‡ bold font indicates informal collaboration in Phase 1
X indicates planned MOUs for Phase 2

While the plan was in place to start the scaling-up the crop programme's formal linkages to the SAUs, the end of the first phase and the start of the second were beset by a number of serious issues involving the failure of CAZS-NR to win the competitive bid to provide consultancy support for the second phase, and the transfer and removal of staff in KRIBP itself.

The team of consultants from Swansea and Bangor would have been responsible for making a bid for the second phase towards the end of phase one. However, Witcombe recalled that at the time the bid was due to be submitted none of the team were around – "...*everybody* was away for some reason or another"[71]. The bid was won by the consultancy firm W.S. Atkins

[71] John Witcombe Interview, Bangor, 9th October 2012

International in partnership with NR International. The impact on the crop programme however, amounted to no more than a minor delay as Witcombe and Paul Smith (SWC) were invited back almost immediately by the Indian project management as they did not like the new consultants, and deemed Witcombe and Smith to be integral to delivering their respective programmes (*Ibid*.).

Although the issue of a technical consultant lead for the crops programme was addressed quickly, the start of the second phase posed several institutional and managerial problems amounting to severe delays to the start of project activities. KRIBHCO faced an internal staff dispute over its management of staff contracts between phases[72].

In 1998, at the end of phase one KRIBHCO closed down KRIBP for six months before the start of phase two. Mr. Prabhjot Sodhi, the manager of WIRFP, had projected a threefold increase in the number of personnel that would be hired and trained by the project during phase two in order to scale-up the approach. According to Witcombe KRIBHCO management were concerned about creating permanent positions within the parent company for staff on the KRIBP, so they decided to terminate everyone and then rehire them[73]. However, KRIBHCO chose to only selectively rehire KRIBP staff after re-interviewing them for their old positions. This caused a lot of internal strife within the project and Sodhi became embroiled in a class-action law suit directed against KRIBHCO, to which he was named a party, by approximately 100 disgruntled staff, even though he himself was against the fire and rehire policy. Sodhi was trapped in the middle and accused by former colleagues and his KRIBHCO bosses of siding with the other parties. After talking with the plaintiffs all but 18 dropped the case, but KRIBHCO management was never-the-less furious with Sodhi, who they accused of instigating the staff, and refused to rehire the 18 pursuing the case[74]. This led to KRIBP staff on the second phase having three different contracts (mainline KRIBHCO, KRIBP old and KRIBP new), and the loss of 18 experienced staff members (*Ibid*.).

The court case antagonised many of the staff, but KRIBHCO also caused problems by shifting company mainline staff into positions within the project for which they did not have appropriate backgrounds. Arun Joshi, one of the main crop specialists who had worked closely with Witcombe during the first phase, was made a state coordinator against his will[75].

[72] John Witcombe, Arun Joshi and Prabhjot Sodhi Interviews (See Appendix 3)
[73] John Witcombe, Arun Joshi and Prabhjot Sodhi Interviews (See Appendix 3)
[74] The case was never settled according to Mr. Sodhi.
[75] Prabhjot Sodhi Interview, Delhi, 11th May 2011

This new position was removed from the crop programme and consisted of a more administrative role. In 2000 Joshi was shifted to his original marketing job for KRIBHCO in Andhra Pradesh and he left KRIBHCO two years later after 10 years on the project[76].

One of the reasons for the gap between the two phases of the projects was due to a restructuring of its organisational structure. Witcombe recalled that while the project had initially hoped that by partnering with a parastatal organisation such as KRIBHCO the project would not be limited by sclerotic bureaucracy that characterised much of the public sector[77]. Unfortunately KRIBHCO's understanding of agriculture was predominantly focused on external inputs and fertiliser and the management did not fully engage with the participatory methods and approach used in the project (*Ibid.*). Furthermore, the way in which KRIBHCO disbursed funds required the filling in of forms called 'Green Sheets' which created further administrative delays in carrying out project activities.

Both Sodhi and Jones were responsible for co-drafting the second phase of the project and as part of this process Sodhi recalled three major stipulations that they made with DFID's support: that there be a new institutional form for the project with its own procedures and systems, distinct from KRIBHCO; that there be an open selection process for assigning staff positions; and that women would be selected for more prominent roles within the organisation[78]. To this end in 2000 KRIBHCO, DIFID and the former PMU set up the Gramin Vikas Trust (GVT) as an NGO and independent legal entity to manage what would then be known as the WIRFP and EIRFP for the second phase of the project. In setting up GVT as an NGO there was a further delay to the start of the second phase since the NGO had to be formally registered before it could receive foreign funding.

The delays brought about through the change in institutional make-up of the project, the moving of project staff and the court case caused a degree of ill will between different parties. Sodhi recalled not arguing with DFID over policy but more with his KRIBHCO superiors over the day-to-day running of the project, and which reached a peak when he was awarded an MBE by

[76] I do not know the exact reason for the move but from interviews with Mr. Joshi and Mr. Sodhi it seems a combination of his intense frustration with KRIBHCO management, although it is unclear from the interviews whether they forced or he chose the transfer.

[77] John Witcombe Interview, Bangor, 9th October 2012

[78] Prabhjot Sodhi Interview, Delhi, 11th May 2011: Sodhi managed to get a woman into a State Coordinator job within the project.

the British government for his role in the project[79]. He was accused of appropriating the award instead of his superiors and in 2002 he was transferred to KRIBHCO offices in Delhi whereupon he tendered his resignation[80]. Mr. Sodhi was subsequently replaced as head of the WIRFP by Mr. K. S. Sandhu, however, the project had lost two key personnel who believed in PCI as a methodology and had a strong working knowledge of the project, its history and contacts within the SAUs and ICAR.

Inevitably the project's organisational shakeup and delays extended to the implementation of the crop programme's research activities, new crop trials and the signing of the expanded raft of MOUs with the SAUs. By the end of the first phase the maize breeding had been completed at GAU and Witcombe recalled using some "workarounds" such as transferring the chickpea activities to ICRISAT[81]. However, to rectify the stalled crops programme and get the new MOUs signed Witcombe pursued a new approach. In an Aide Memoire from 1996 he wrote,

> "How are linkages with SAUs to be established? As these are with plant breeders, a recognised plant breeder needs to be involved in these negotiations. Either a plant breeder with progressive ideas on farmer participation needs to be recruited as a core team member, or a consultant needs to be employed on a regular basis until the programmes are well established and accepted by the SAUs as part of their normal research activities." (Ibid.).

Securing the services of a "recognised plant breeder" to negotiate the MOUs and make sure that the collaborative SAU work plans were being implemented represented a new strategy for the project since the only dedicated plant breeders, Virk and Witcombe, were foreign consultants whose visits were short with packed itineraries. With Sodhi and Joshi having left, the project needed dedicated plant breeding consultants to oversee the crops programme in the WIRFP and EIRFP. The two plant breeders chosen for the crop consultant roles were Dr. J. P. Yadavendra (WIRFP) and Dr. S. C. Prasad (EIRFP). Table 16 shows the status of the MOUs at the beginning of September, 2001.

[79] Prabhjot Sodhi Interview, Delhi, 11th May 2011
[80] Mr. Sodhi is now the manager of the UNDP Small Grants Programme based in Delhi
[81] John Witcombe Interview, Bangor, 9th October 2012

Table 16 - Status of MOUs for WIRFP as of 1st September 2001

Institute	Crop	Location
MPUAT	Maize	ARS Banswara
	Chickpea	ARS Banswara
	Rice	ARS Banswara
GAU	Maize	Godhra
	Rice	Dahod
	Horsegram	Dahod
JNKVV	Horsegram	KVK Jhabua
	Rice	KVK Jhabua
	Maize	KVK Jhabua
	Chickpea	KVK Jhabua
	Black gram	KVK Jhabua
	Niger	KVK Jhabua

Source: Witcombe Aide Memoire September 2001

During the latter part of the first phase and early second phase the project funded exposure visits for plant breeders to sensitise them to participatory methods outside of their organisations and their associated organisational politics. Sodhi recalled that between 1997and 2000 a number of trips were arranged for maize, rice and chickpea breeders at JNKVV, GAU and RAU and their Directors of Research to visit the UK for five day training programmes[82]. Prior to joining GVT as the WIRFP crop consultant, Yadavendra had experience of KRIBP(W) / WIRFP's crop programme activities as he was a plant breeder for eight years at Derol research station, close to the project headquarters in Dahod, Gujurat. During this time members of the crop programme brought plant material to Derol to be tested and discussed the participatory methods with researchers there.

In 1997 Yadavendra had the opportunity to visit the UK for a participatory plant breeding course with other staff from GAU. When GVT approached Yadavendra to join the project he was a professor and head of plant breeding and genetics at GAU and was a year away from retirement. As part of his role at GAU, Yadavendra was head of the ICAR Fodder Unit and administrative head for all other ICAR and AICRP projects at the SAU. Yadavendra said that he was keen to join the WIRFP on a deputised basis as he believed in the PCI approach, but that GAU would not allow it as they needed him at the university[83]. Finally after a lot of cajoling on

[82] Prabhjot Sodhi Interview, Delhi, 11th May 2011. John Witcombe recalled that there were definitely at least two training programmes for plant breeders at the University of Wales, Bangor

[83] Yadavendra Interview, Dahod, 30th April 2011

the part of GVT Yadavendra retired eight months early and finally joined the project in May 2004, although he had originally stated that he intended to join in January 2002[84]. Due to his contacts within the public plant breeding system and GAU, Yadavendra was able to act quickly and get all the outstanding MOUs signed with the three SAUs and aid in the project's other crop activities. However, he came to the project late in the second phase, a year and a half before it ended, and the failure to secure a dedicated crop consultant earlier may have delayed many of the collaborative breeding programmes and what they could have subsequently achieved.

In total there were 16 MOUs signed between GVT and the SAUs for the second phase, two of which were not related to plant breeding. Each of the plant breeding MOUs consisted of a similarly worded contract which linked a senior plant breeder (principle investigator) to the project (*Cf.* Annex 4 for an example of a second phase MOU). Since these breeders were busy with their other research and training commitments, each MOU made provisions for the funding of a Senior Research Fellow (SRF), usually a postgraduate student, to carry out the actual breeding and trial activities for the duration of the project. The MOU provided funds and a motorbike to facilitate the movement of SRFs between field sites. It also provided funds for carrying out workshops events at the SAU and the formation of a technical committee that included key staff at the university (Directors of Research and Extension, *inter* alia) and from GVT to coordinate and assess the progress of the research biannually. Where appropriate GVT staff would also be represented at ZREAC and other university meetings that discussed the research.

The outcome of the WIRFP MOUs and the achievements of the Indian Niche are discussed in more depth in the following chapter.

[84] John Witcombe Aide Memoire September 2001

5.4 Discussion

Sub-Research Question 2:

> *How did the PCI aspect of WIRFP manage its interactions with the plant breeding socio-technical regime and other PCI projects and organisations?*

The information presented in the chapter thus far plots the institutional evolution of PCI methods throughout the first and second phases of the WIRFP. Initially the project had a more open approach to how PCI might be carried out, but this later coalesced into a more structured approach on account of interactions that occurred between individuals and organisations internal and external to the project. In the preceding chapter I considered some of the socio-technical factors which characterise the Indian NARS. In this section I aim to carry out a similar socio-technical characterisation of the WIRFP project and use it to address the sub-research question presented above.

The *organisational structure* of the KRIBP and WIRFP is important because it highlights a number of different dynamics that impact on all the other socio-technical factors. DFID chose to work with a para-statal organisation to try and side step the level of bureaucracy that permeates many government institutions. Unfortunately KRIBHCO had its own inhibitive bureaucratic culture that led to DFID and project leaders pursuing a new, more autonomous management structure through the formation of an NGO, GVT. This organisational restructuring was not without cost due to the delays it brought to the second phase of the project. The initial decision not to work directly with the public sector may have allowed for a degree of autonomy for the crops programme to experiment and develop PCI methods, but it also had the effect of distancing it from the SAUs themselves.

By referring to KRIBP/WIRFP as a 'project' it is easy to perceive it as a homogenous entity rather than as a coalition of different organisations signed up to a common goal for a particular duration. The different organisations and stakeholders making up the project may have signed-up to its goals, but they still retain their own needs and objectives, both internal and external to the project. In the UK DFID provided the majority of the funding, but there was also the team of consultants from Swansea and Bangor. In India there was KRIBHCO, and later GVT; the staff hired to carry out the project; and eventually the SAUs and even CGIAR centres (ICRISAT, IRRI, CIMMYT) who provided more distant help in the form of germplasm supply and testing.

As the donor and principle agency DFID occupied a privileged position at the apex of the project's hierarchy. Many of the *knowledge management* activities of the project were directed towards its M&E obligations to DFID, while also trying to manage DFID's assessment of it. DFID took on the role of kingmaker or kingbreaker since its annual and mid-term reviews could determine the project's future funding levels or even its continued existence. The position and power of the donor in relation to the project correspondingly skewed the project's *user relations & accountability* away from its clients and partners towards the donor. Despite the project having a 'participatory' focus and actively choosing to engage with its purported beneficiaries, it tended to deliver its interventions in a collaborative manner through COs, but the larger programme activities such as PVS/PPB were pre-chosen and at times more consultative or passive (*Cf*. participatory modes of engagement). The relationship between SAUs and the project's crop programme was largely contractual – as evidenced by the MOUs. Principle investigator plant breeders carried out a largely project-prescribed PCI agenda, but this was separate from their other research and the work of their colleagues.

The crops programme itself was nested within the larger KRIBP/WIRFP projects. Dr. Witcombe as the crops consultant for the project and manager of the PSP could direct streams of funding towards multiple parallel complimentary crop improvement projects, resulting in what I have termed the PCI niche. Although PCI activities were carried out in other South Asian countries, the KRIBP/WIRFP represented a project of central importance within the niche due to its scale and the number of research partner SAUs involved. The formation of a broad PCI research network (niche) could only have taken place due to the pivotal positioning of Dr. Witcombe and the availability of funds to carry out such projects. Using development funds and operating within the context of a development project conditioned the formation of PCI *narratives* and *praxis*.

PCI, as carried out by WIRFP, was strongly influenced by FPR, the core narrative assumptions on which PCI methods are built. Much of the FPR and subsequent PCI narratives are based on a strong second-order critique of conventional research systems. This places PCI at best as a complimentary method to conventional R&E practices and at worst, in terms of potential cooperation, in opposition to them. PCI, and in particular PPB narratives, compete with different normative explanations for the poor adoption of novel agricultural technologies. If poor technological adoption can be explained by current theories, i.e. due to a resource-throttled extension system, then this further reduces the favourability of the narrative. The

PCI narrative has also developed around and supports the roles of the project's constituent organisations. The project funded GVT to have a presence in the tribal regions acting as a parallel pseudo-extension system to the state. Moreover, the *organisation structure* of the project directly influenced the *praxis* of the PCI crop programme. GVT acted as an extension system proxy in areas where the state's system had minimal penetration and presence. GVT's role and the project's predetermined infrastructure to some extent conditioned the role and degree of involvement of the SAUs. Instead of involving the whole of each SAU, and in particular its extension system, research was contracted out in the form of the MOUs described in this chapter.

Over time, key stakeholders such as Witcombe, Virk, Sodhi, and Joshi occupied leadership roles within the project. Since the consultants for WIRFP and EIRFP were based in the UK, their visits were compressed within a short time frame and adhered to rigid and predetermined terms of reference. As attested to in their various aide memoires the consultants had short meetings with SAU staff prior to and after the signing of the MOUs. GVT and CAZS-NR organised several PCI training programmes and workshops for staff and researchers in the UK and India. However, although Witcombe and Virk provided leadership on the technological aspects of the crops programme, their lack of presence in India could have reduced their potential for sensitising SAU and ICAR staff to the project and developing a rapport among them. This was partially rectified through the hiring of Dr. Yadavendra, however, it came too late in WIRFP's second phase to have much effect on staff within ICAR and the SAUs.

The MOUs acted to formalise the relationship between the SAUs and WIRFP, however, the involvement was largely a consultative form of participation in which the SAU carried out a predetermined research agenda and associated tasks. As the plant breeding at the SAUs proceeded and varieties became ready for release, the protected partnership between the WIRFP and the SAUs came into conflict with the *policy & regulations* of the wider research system in terms of the varietal release system and procedures. At the ZREACs and University Varietal Release Committee the principle investigator plant breeder and GVT staff had to present and defend their different research methodology in the face of their peers and established VCU and DUS criteria. These conflicts might have been better managed through sensitising *all* the R&E staff to the purpose and science behind PPB and PVS.

Sensitising all the staff requires a sympathetic Vice Chancellor and Directors of Research and Extension. Successful *boundary management* by a project is dependent on the type of

organisation at the boundary. GVT made efforts to communicate the message of PCI across its project boundaries; however, efforts to *translate* and *mediate* the message to staff at the SAUs were not as successful. I believe that this is in part due to the role of SAUs as external partners to WIRFP rather than incorporated more centrally within it; the removal of key project staff at the beginning of the second phase; and, the late arrival of a project *intermediary* in the form of Dr. Yadavendra who may have been able to translate and mediate the PCI message to his former colleagues.

As seen throughout this and the previous chapter's discussion, the factors of power, space and time co-dependently arise with each other in the articulation of niche and regime structure, function and their interactions with each other. The temporal ordering and codification of KRIBP and the subsequent WIRFP structures conditioned to a large degree the interaction that it was able to achieve with the Indian NARS. In particular, the contractual nature of these interactions may have limited the extent to which the niche could engage with the type of regime actor who could effect institutional change within their NARS organisation.

'Space' is an important factor in the functioning of the niche since the project had to be accountable to DFID, consider and engage with global developments in PCI methods, and interact with many stakeholders across different locations in India and further afield. The process of understanding and influencing the interplay of power dynamics between different partners concomitantly during the project would be challenging for any project manager. However, the conceptual framework, with its adaptation of an SNM approach to the development project context, if applied at the start of a project, may allow project planners to characterise organisational structures, narratives and praxes in advance and in such a way as to identify modes of interaction that can negotiate around institutional bottlenecks to institutionalisation.

The next chapter will consider the legacy of the PCI niche after the end of WIRFP with respect to the RIU Programme, the institutionalisation of PCI, and its use by NGO project partners.

6 PCI: The WIRFP Legacy

6.1 Introduction

The second phase of the WIRFP ended on 30th June, 2007 – after having been granted an extension of one year by DFID. Most projects have a final reporting cycle in which consultants, internal and external to the project, are charged with evaluating the project's outcomes relative to its objectives. Reports are generated by project staff which provides a story of the project, outlining its achievements and styling it as a 'success' (Sumberg et al., 2012a). There can be pressure from within projects to promote a 'success story' in order to legitimise the approach taken, secure future funding and help steer changes in agricultural policy (*Ibid.*). The concept of 'success' is necessarily a subjective construction; having been created by a person or people it is open to contestation by others who evaluate the evidence differently. Moreover, any account of success is a snap-shot that may be re-evaluated on the basis of new perspectives and emergent and contingent events which follow the initial evaluation.

Whereas the previous chapter described the WIRFP and the broad activities of its crop programme, in this chapter I first consider the immediate achievements of the PCI niche at the culmination and end of the WIRFP before positioning the WIRFP in the context of other major projects that constitute the larger PCI niche (See Figure 10, Chapter 5, for a timeline). Next I consider the success of the niche in terms of the new crop varieties it produced; how the new varieties were at the forefront of the success story; and how the success of the project is eroded by seed supply issues. The last measure of success that I address is that of the new scientific knowledge and publications that came out of the project and how these may have lasting value since they are not dependent on the current status of project organisations and context.

After discussing the immediate outcomes of the WIRFP crop programme and how it characterised its achievements, I discuss the legacy of the WIRFP to 2012. In particular I consider how the niche tried to maintain the activities of its research network by securing other sources of funding for projects, and what effect this had in relation to it being able to carry out PCI methods, specifically plant breeding. This post-WIRFP phase of PCI activities saw a shift away from plant breeding towards an expansion in the uptake of PVS by NGOs and its

use in other development projects in the old WIRFP project area and further afield. I then discuss DFIDs involvement in these projects and the shift away from research back to a development focus, and the implications this has for future 'projectised' forms of PCI.

Lastly I will illustrate the limited mainstreaming of PCI methods in the Indian NARS. In particular I draw on the experiences of the project trying to integrate its form of crop improvement into the SAU system and show that, although it was necessary to work with SAUs, the nature of the collaboration (MOUs) meant that there was little institutional change within the organisations. Moreover, despite many efforts to engage with the public plant breeding regime at State and National levels, the project has largely failed to significantly alter dominant scientific praxis.

6.2 The Immediate Post-WIRFP Niche Achievements

The end of the WIRFP was succeeded by a flourish of internal and external reviews which presented the project's achievements and reasserted the importance of the PCI narrative as a successful and legitimate way of helping poor farmers. As part of the log frame for the second phase there were a number of core project outputs broken down into different components and assessed by independent reviewers:

- Component A: Livelihoods of 465,000 poor people enhanced in 275 'core' and 550 'proximal' villages.
- Component B: Project technologies and approaches disseminated through partnerships.
- Component C: Participatory Technology Development (PTD) – *New farming systems technologies generated, tested and made available in project villages and more widely in the region.*
- Component D: Policy Influencing – *Lessons from WIRFP used to influence policies of state and national governments*.
- Component E: Migrant Labour Support Programme (not addressed in this thesis)

Components 'C' and 'D' are most relevant to the thesis since they mainly focus on the crop programme and the degree to which it has influenced policy. However, the crop programme was not separate from the project and there are a number of achievements and issues arising out of this broader project context that are directly relevant to the crops programme. Firstly,

at the start of the project participatory methods were in their infancy in India and elsewhere, and had not been applied on a wide scale and implemented over a sustained period. Through the writings outputs of its staff members and consultants KRIBP/WIRFP yielded insights into the ways in which participatory methods could be implemented, and provided a critique on some of the limitations of this set of development and methodological approaches. Mosse had used his experiences on the project to generate a series of strong reflexive critiques on participatory methods and how they have the capacity to be used by their implementers to legitimise their approach while disguising the uneven power relationships that persist between developers and the developed (Mosse, 2005)[85]. Secondly, the broad approach of SHGs, the *jankar* system, and bottom-up development approaches pioneered under KRIBP/WIRFP have been refined, altered and used in subsequent development projects in India by DFID and other development agencies, such as the Watershed Development Programmes and Rural Livelihoods Programmes. The Rural Livelihoods Programmes, in particular, will be discussed later in this chapter.

Both the component 'C' and 'D' reports were written towards the end of the second phase in 2006 and exude a cautious optimism with respect to the outputs of the project since then it was not possible for the consultants to foresee the sustainability of project impacts, such as the new PPB varieties (Gill et al., 2006, Sharma et al., 2006). The PTD impact assessment states that PVS represented a return on DFID's investment because it spread the products of the project wider, whereas PPB takes less time than conventional breeding and minimises the risk of rejection (Gill et al., 2006: 6-7). However, the consultant team were reserved about the extent of the possible impact of the PPB varieties since at the time of writing many of them were still in the pipeline. They ascribed this lack of progress directly to delays in starting the second phase and estimated that the crop programme had been compressed to three and a half years out of a projected seven (*Cf.* previous chapter for reasons for delay). The assessors made the case for official release of the pipeline varieties, because,

> "(a) it makes it possible for a variety to enter the State's package of recommended practices, thereby qualifying for subsidies, (b) released varieties can enter the NBPGR data base and thus become available for future PVS work, and (c) release will trigger recognition for the researchers who developed these varieties and hence enhance both their promotion prospects and prospects for participatory approaches becoming institutionalised within SAUs." (Gill et al., 2006: v)

[85] The crop programme has also yielded a prodigious volume of writing, much of it peer reviewed, which will be discussed further under the publications section below.

Their suggestion to DFID was that the crops programme be funded for an extra two years at a cost of ~£100,000 in order for the pipeline varieties to be released.

The assessors were optimistic regarding how PTD had been received by SAU staff saying,

> "Signs of sustainability of participatory approaches at these universities are encouraging, but it cannot yet be said that there has been a wholesale conversion to such approaches." (Gill et al., 2006: vi)

This resonates with point 'c', quoted above, and with their observation that some plant breeders were teaching PPB to their undergraduates and that research was being carried out on rain-fed tribal areas where previously it had not been. My fieldwork indicates that these were overly optimistic claims and that change in scientific praxis has been minimal within the SAUs.

The PTD impact assessment also singled out potential issues with sustaining the benefits of the new varieties due to the fragility of prevailing seed systems. They argued that private seed companies were not interested in the rain-fed varieties due to their low profitability, and that the current seed SHGs were overly subsidised and not sustainable economically. In 2006 four of the eight seed SHGs established by GVT had folded. Part of the problem of the SHGs was their over subsidisation coupled with unsustainable business model (marketing the seed at too low a price), but part of it was due to farmers being unable to carry out seed multiplication activities on their poor land without irrigation. The report suggested that better-off farmers be approached for seed multiplication, because without functioning SHGs farmer-to-farmer dissemination of the new varieties was likely to slow or disappear entirely.

The authors of the policy influencing study (Component D) made it clear from the outset that determining policy influence is a difficult task since few rural development projects contribute to government and national processes, and many of the activities and their interactions with stakeholders through which influence may develop occur in a non-linear fashion (Sharma et al., 2006). Moreover, the WIRFP had provided no dedicated staff or strategy for carrying out component D. The study never-the-less considered the whole of the WIRFP and ascribed different levels of policy influence to its different elements[86]. The report stated that PVS/PPB

[86] In their policy influence matrix Sharma *et al*. (2006) denote three types of policy influence ranging from: 'Substantive' relating to actual policy change; 'Procedural' concerning changes in behaviour and

generated a substantive institutional influence in that, "It has helped release new varieties and has gained scientists' confidence in the participatory techniques. Evidence to suggest that client-responsive research has become a policy does not exist but the continuing thrust for getting it into the agricultural teaching/research system will yield the desired impact (Sharma et al., 2006: 9)."

However, the opinion of the consultants was not mirrored by Witcombe who they recorded as saying,

> "PVS and PPB has gained the support of the scientific community but it has not influenced any bit to change policy at any level. Strategically, the project did not position the activity to influence policy. It is indeed frustrating that nearly 15 years of participatory work has not taken us any further. There is no evidence to suggest that ICAR institutes have been told to follow PVS & PPB in their varietal release systems." (Sharma et al., 2006: 11)

Although they acknowledged Witcombe's difference in opinion the assessors remained positive that in future the conditions for systemic institutionalisation might become more favourable over time, though they do not say how or under what conditions this may occur (*Ibid*.).

With hindsight the balance between the views on institutionalisation held by Witcombe and the Component D assessors has shifted strongly in favour of Witcombe (*Cf*. Section 6.4 below). This may be in part be due to the assessor's failure to grasp the rigidity and requirements of the varietal testing and release procedures and or the willingness of scientists to talk congenially and positively about the projects when there was still the potential to secure more future funding.

There is also a big difference between sensitising individual scientists and generating systemic organisational changes altering their organisational praxis. At the end of their report the assessors provide a list of actions that should have been considered by the project in order to strategise its policy influencing activities; these include:

1. Understanding the system
2. Telling persuasive stories (other than critiques)
3. Building networks
4. Coordination and facilitation of knowledge and activities of stakeholders

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praxis; and, 'Attitudinal' referring to sensitisation of an individual or organisation. These three types of influence can in turn be applied individually, organisationally and systemically.

5. Convening key events (workshops etc.)
6. Communication strategy (target message to important stakeholders)
7. Opportunism and Serendipity

However, as described in the previous chapter the crops programme implemented all these activities at one time or another. So why then were there no substantive and systemic changes to the SAU's plant breeding policy? One explanation could be that these steps were applied by the crop programme and project in an *ad hoc* manner without an overarching strategy. While there may be some truth to this, an hypothesis arising from my research is that it was the way in which the project engaged with the SAUs through MOUs is at the heart of the matter. This and other issues will be discussed further at the end of this chapter.

6.2.1 Novel PCI Varieties

The new varieties resulting from the WIRFP and EIRFP and the wider niche represented the pinnacle of achievement for the crop programme and the central output of Component C of the second phase of WIRFP. The collective package of PRA, PVS and PPB methods helped to inform the crop programme on the types of crops the farmers actually wanted; how current state-recommended varieties performed under farmer managed conditions; and how new varieties could be bred which addressed farming system constraints and farmer and market needs. As a by-product of the WIRFP, SAU plant breeders gained a better understanding of the needs of tribal farmers through their involvement in the project. The presence of novel PCI-derived varieties also demonstrates that NGOs can potentially collaborate with public sector research institutions, and that the PCI methods used can yield varieties which are good enough to pass through the stringent state varietal testing and release procedures. Moreover, the *a priori* supposition that, greater involvement of farmers in the creation of novel varieties gives rise to more appropriate farmer-preferred varieties, has gained *a posteriori* support through the findings of several impact studies on farmer adoption and varietal spread (*Cf*. Witcombe *et al*. (1999); Ortiz-Ferrara *et al*. (2007); *inter alia*).

Mosse (2005:139) refers to these crop varieties as the *"dramatis personae*" of the crop programme, since they took centre stage in the narratives constructed by project staff to describe its outputs and impacts (*Cf.* Stirling and Witcombe (2004); Billore (2006); and, Witcombe and Yadavendra (2006)). The centrality of the PCI varieties within the narratives

supporting PCI is echoed in a series of *ex-post* reviews commissioned by the RIU on the PCI projects in India and Nepal that occurred as part of the WIRFP/EIRFP and PSP (*Cf*. Conroy (2009a)). The report concerning the institutionalisation of PCI in India lists the amount of PVS and COB that took place and the varieties that resulted from the breeding programmes; however, it does not go into sufficient detail regarding the reasons for the lack of institutionalisation of these methods (*Ibid.*). For example, Table 17 shows the COB varieties that were officially released in India, according to Conroy's research. However, 14 MOUs were signed between GVT and the SAUs indicating that some of the collaborations did not successfully yield a novel variety.

Table 17 - COB Varieties Officially Released in India

Organisations involved	Crop	Variety	State(s) in which release sought	Year of release
GAU & GVT	Maize	GM-6	Gujarat	2001
AAU & GVT	Upland rice	Ashoka 200F	Gujarat	Recommended
BAU & GVT	Upland rice	BVD 109 (aka Ashoka 200F)	Jharkhand	2004
BAU & GVT	Upland rice	BVD 110	Jharkhand	2004
GVT & JNKVV	Blackgram	JU 8-6	MP	2005
GVT & JNKVV	Blackgram	JU 4-8-6	MP	2005
GVT & JNKVV	Horsegram	JVH 2	MP	2006
GVT & MPUAT	Chickpea	Pratap Chana 1	Rajasthan	2004
GVT & JNKVV	Chickpea	JG 412	MP	2004
GVT & JNKVV	Upland rice	Ashoka 200F	MP	Recommended 2005
GVT & MPUAT	Upland rice	Ashoka 200F	Rajasthan	Recommended 2004
GVT & JNKVV	Maize	J/IVM 421	MP	2005

Source: Adapted from Conroy (2009a)

Table 17 also lists the state under which the different varieties were released. Since none of the PCI varieties were released through the Central Varietal Release Committee (CVRC) they have to be entered into SVRCs in order for them to be subsequently released in other states. Moreover, when varieties are released they are recommended for different zones within the state which may limit their future spread to other areas within the state through state extension channels.

In an account of the KRIBP crops programme, Mosse (2005:140) describes how the PCI model and the new varieties came to be 'decontextualised' from the wider systems in which they were embedded. This allowed for project staff to make generalisations and impact predictions based on the 'genetic' (varieties) and 'knowledge' (methodological) products derived from the PCI model. However, in ignoring the immediate context of the farming and research systems in which these products were embedded, the project and its assessors immediately after its completion greatly overestimated the benefits that could be achieved by the new varieties.

One of the key contextual factors in maintaining the projected varietal outputs and their impacts is sustaining their seed supply. In 2010, Dr. Witcombe went back to RVSKVV to obtain the PCI horsegram seed for multiplication and scaling-up under the RIU, but was unable to find any at the university[87]. Under the RIU, GVT was only funded to improve the seed supply of upland rice (Ashoka varieties), although GVT has also carried out seed supply for GM-6 and JVM 421 on other projects. None of the state seed corporations (SSCs) produce seeds of the COB varieties other than Gujarat SSC which produces GM-6. Based on enquiries during fieldwork, it seems that the universities and plant breeders involved in the collaborative breeding of seed did not maintain their breeder seed for the majority of these varieties. Furthermore, the public sector organisations responsible for extension activities are neither recommending these varieties nor promoting their multiplication and dissemination to farmers. The reasons for this lack of uptake and promotion of the PCI varieties by the public sector will be discussed in greater detail later on in this chapter. However, the poor availability of seed of the PCI varieties is a serious impediment to farmers receiving benefit from them. Farmers that save seed may be able to preserve and spread the varieties; however, if seed is not replenished then the genetic gains of the different varieties of OPVs will be eroded over time[88].

6.2.2 Publications

One of the immediate and lasting legacies of the project were the publications of staff associated with the project. Published material took several forms, including but not limited to: peer reviewed papers, books, final technical reports, progress reports, impact assessments, working documents, conference papers, electronic bulletins and glossy colour-printed reports

[87] John Witcombe Interview, Bangor, 9th October 2012
[88] This is especially the case with regard to OPVs that lose their genetic purity and yield gains after 3-4 years

marketing the project's approach and successes. The target audience of the reports varied. Peer reviewed journal articles were targeted at the international scientific community, whereas many of the other project documents were oriented towards meeting its monitoring and evaluation obligations to DFID. Project documentation has the potential to be the most sustainable of the project outputs as it is easier to store material in archives electronically than it is to maintain the organisational and institutional structures and processes erected under WIRFP.

Although it is potentially easy to maintain an electronic archive of project documents, many of the KRIBP documents written in the early 1990s have not been electronically archived. Websites that store these archives can overtime lapse or become obsolete as changes inevitably occur within the organisations which manage them[89]. Moreover, the types of documents preserved online tend to consist of sanitised final reports as opposed to the more critical external and mid-term project reviews[90]. In the section below I outline some of the major events and documentation arising directly from the KRIBP/WIRFP project and the wider niche, in particular the PSP.

The project documentation addressed different issues at different times which allows for a picture to be drawn together of the progressive development of methodologies and insights drawn from its consultants and staff. The social scientist consultant David Mosse first published articles addressing problems in the application of PRA methods which were reported on in PLA Notes (Mosse and Mehta, 1993, Mosse, 1995). His reflexive critiques on project methodology developed over the course of time from considering the role of authority, gender and knowledge in PRAs (Mosse, 1994) to a more refined and focused critique on his experiences in KRIBP during the first phase and participatory development in general (Mosse, 2005). This latter account of the project is strongly contested by some of his former colleagues, but the issues Mosse raised were echoed by a growing number of development

[89] GVT website has only recently been updated and overhauled (December 2012). Its earlier iteration had remained largely unchanged since the end of the WIRFP. Of a series of bulletins that it produced, a number are corrupted or inaccessible. The domain for the PSP-dedicated website documenting much of the programme's achievements has lapsed but much of the documentation can still be found on the CAZS-NR website.

[90] It is not my intention to be disingenuous here and suggest that the masking of critical reports is actively carried out by project staff through the selective archiving of specific types of reports over others. The more critical reports may not be archived due to their limited interest to the general public. However, by focusing on final project documentation it is my opinion that much of the DFID, CAZS-NR/PSP archives *do* present a limited selection of documents that largely contain the kind of 'success' narratives that one might expect in these documents at the expense of those expressing concern and dissent.

professionals and academics culminating in the 'Tyranny of Participation' conference and book[91]. The experiences and ideas reported in this book suggesting that 'participation' is another means of pursuing traditional, top-down development agenda, can undermine some of the assumptions underpinning the narrative of 'participation' as a viable method of addressing the problem of inequality, power and gender issues within development (Trevor, 2004). This challenging of the sanctity of the participatory narrative in the late '90s may have affected the ability of development projects to secure new funding for solely participatory projects.

As a methodology PCI followed its own development and reporting trajectory. At the start of phase one there was some experimentation on farmer participatory selection reported in the scientific literature (Maurya et al., 1988, Ashby et al., 1989, Sperling et al., 1993b), but nothing on PPB. It was Witcombe and colleagues who first coined the phrases PVS, PPB and PCI when they delivered a paper at two IPGRI/IDRC-funded conferences held in Wageningen, The Netherlands, and India in July, 1995 (Witcombe and Joshi, 1996)[92]. These conferences included Jacqueline Ashby and Louise Sperling who would later be closely involved in the PRGA. The year after the conference Witcombe and colleagues published a four part series of papers on PCI in the Experimental Agriculture journal (Witcombe et al., 1999, Witcombe et al., 1996, Joshi and Witcombe, 1996, Sthapit et al., 1996). The initial series of papers concerned PVS and PPB methods carried out in India and Nepal and their impact on biodiversity and seed dissemination. In recording the experiences of PCI application, the papers might show other plant breeders plant breeding methods and statistical tests that could be useful to their own research. The papers that Witcombe co-authored came from the different experiences of projects in the broader research network such as PSP-funded projects, other than just KRIBP/WIRFP. One benefit of managing similar projects was that the PSP not only provided a wide range of project experiences to write about and generalise from, but also the funds to write them up when the money was not always in the KRIBP budget to do so[93].

As the PCI approach evolved under KRIBP/WIRFP and in the wider niche, so did the issues addressed in the published journal articles. During the first phase of WIRFP PVS was tried under more favourable agro-ecological and socioeconomic conditions in India and Nepal in the HPPS work (*Cf.* previous chapter) (Virk and Witcombe, 2000, Witcombe et al., 2001). What

[91] Consultant Aide Memoires and foreword of Mosse's Book (2005).
[92] John Witcombe Interview, Bangor, 9th October 2012; Bhuwon Sthapit Interview, Delhi, 10th May 2011
[93] John Witcombe Interview, Bangor, 9th October 2012

was initially termed FAMPAR and PPB was altered by the experiences of project staff and scientists working with farmers across the different projects in the niche and came to be referred to as Client-Oriented Breeding (COB) (Witcombe, 2005, Witcombe et al., 2005, Virk et al., 2005, Witcombe et al., 2006, Joshi et al., 2007, Virk and Witcombe, 2007, Gyawali et al., 2007). The practice of COB considered more closely the efficiencies and skills of farmers and scientists and how they could best be used in collaborative plant breeding. When working with scientist partners and their research station infrastructure, involving farmers at every stage of the process was not always feasible (*Cf.* Morris and Bellon (2004)). COB therefore contains and transmits the lessons gleaned from the accumulated experiences of the WIRFP, EIRFP and Nepalese projects.

The majority of these articles were published in the *Euphytica*, *Crop Science*, *Experimental Agriculture* and *Field Crops Research* journals[94]. All these journals are international journals in which multiple articles on PCI have been published. Witcombe, to the best of my knowledge, has only had one co-authored paper published on Ashoka rice in the *Indian Journal of Agricultural Sciences* (Witcombe et al., 2007). This perhaps represents a missed opportunity for targeting the Indian NARS by publishing articles on PCI methods in Indian journals, but which is offset by the journals' wider readership. Towards the end of the second phase GVT staff, Witcombe, Yadavendra and SAU partners co-authored several papers which were presented at a number of symposia and conferences in the country (Pathak et al., 2005, Patel et al., 2005, Yadavendra et al., 2005, Mehta et al., 2005, Yadavendra and Witcombe, 2006)[95]. However, while a paper presented at a conference on PCI might *sensitise* some individual scientists to the potential of PCI, it is unlikely to help those scientists address institutional barriers to PCI and bring about a *systemic* policy change to the research practices of their respective organisations.

The peer-reviewed papers and the experiences on PCI contained within have the potential to contribute to future sensitising of plant breeders to the benefits of greater farmer participation in research and extension. Witcombe has made written contributions to a number of different publications, including book chapters on varietal testing and release procedures as well as the FAO plant breeding manual (Witcombe et al., 1998, Tripp, 2000, Ceccarelli et al., 2009); however one of the biggest repositories of PCI work is on DFID's R4D

[94] The journals listed are the main ones that Witcombe has published in ranking from highest to lowest according to Web of Knowledge.

[95] Dr. Yadavendra (Interview) recalled presenting a paper for a symposium held by the Indian Society of Genetics and Plant Breeding, although I cannot find information to verify this.

website. All of the PSP projects, which overlap with WIRFP/EIRFP experiences, have DFID 'validated output documents' and final technical reports that summarise the achievements of the PSP and should be available to the public for the foreseeable future. However, reports such as these and the final glossy colour documents, which were published at the end of WIRFP, provide a sanitised snapshot of what the project achieved and not the problems associated with seed supply of the new varieties which herald, for the most part, their gradual disappearance and lack of availability to farmers (Stirling and Witcombe, 2004, Witcombe and Yadavendra, 2006, Billore, 2006)

6.3 The Legacy

The immediate achievements of WIRFP have been documented above, these were reported on towards the end of the project and in the period not long after it finished. They therefore represent a snapshot of what consultants and project staff had achieved and, to some extent, their predictions for what might happen next. The publications that came out of the project and its wider niche can be considered as the legacy of the project, but what happened to the project implementing NGO GVT, and was the niche able to secure more funding for PCI work? Furthermore, to what extent had PCI made an impact on the plant breeding activities of the former SAU partners? The rest of this chapter aims to present what happened next for the Indian niche and provide some reasons for the inability of the project to mainstream its mode of research in the Indian NARS.

6.3.1 Post-WIRFP GVT Activities and the Research Into Use (RIU) Programme

On the culmination of WIRFP/EIRFP project activities in 2007, the funding provided by DFID to GVT stopped and the MOUs that had been in place with the SAUs were not renewed. GVT had been formed to implement WIRFP and for the previous decade had been principally funded through DFID. It now had to generate its own income and approach to rural development. The PSP had also finished in 2006 so the research network and the partnerships that had formed over that period could no longer be supported through applying to the PSP for competitive grants. In September 2005 a DFID-sponsored conference, 'Pathways out of Poverty', was held in Cambridge involving three of the externally-managed RNRRS

programmes, including the PSP[96]. Witcombe recalled that at the conference he met with representatives from DFID who said that the next programme, Research Into Use (RIU), would be about the promotion of research outputs that were "on the shelf", not more research. Witcombe argued that some more research was needed to be done in order to finish off varieties in the pipeline, but to no effect.

Immediately after the end of the PSP and WIRFP, CAZS-NR managed to secure funding for a project called FOSRIN: Food Security through Ricebean Research in India and Nepal that ran from April 2006 to March 2010 (Hollington et al., 2010). The project was run as a consortium of which CAZS-NR was the coordinator; and the project included GVT and Nepalese NGO partners among others (Hollington et al., 2010). Ricebean breeding work was carried out by two new SAU partners, but it involved client-oriented principles used to identify parents for the cross, falling short of full-COB (*Ibid*). GVT's role in the project was predominantly PVS, but Yadavendra was retained by the project and acted as the country coordinator for India.

Since the end of WIRFP, Dr. Yadavendra has put together funding proposals for carrying out further PPB/COB work in collaboration with SAUs but has been unable to secure funding[97]. He thought the reason for this was that plant breeding as a development narrative was out of fashion. Instead, GVT has worked on a number of different rural livelihoods projects in which PVS and seed provision have been a factor (*Ibid*.):

- Management of KVK Godda District Jharkhand from 2006, although mentions FLDs no specific mention of PVS.
- Rockefeller foundation funds the continuation of seed multiplication of the Ashoka 200/ 200 F rice varieties in collaboration with Birsa Agricultural University (BAU) and CAZS-NR that had previously gone on under EIRFP.
- Madhya Pradesh Rural Livelihoods Programme (MPRLP) funded GVT to carry out PVS in Jhabua district for part of the first phase (2006-08). GVT involvement was not renewed for the second phase of MPRLP[98].
- Sir Ratan Tata Trust (SRTT) funded *Kharif* Maize Stabilisation Project 2009/10 and Sustainable Rain-fed Agriculture Project 2008-2011[99]. These projects included PVS and seed multiplication of JVM-421 and GM-6 maize varieties. GVT helped establish a

[96] John Witcombe Interview, Bangor, 9th October 2012
[97] Yadavendra Interview, Dahod, 30th April 2011: Swiss Development Corporation, Ford Foundation, ICAR, MPRLP
[98] Yadavendra Interview, Dahod, 30th April 2011
[99] Mr. D. K. Sharma (Regional Programme Manager GVT) Interview, Jhabua,

cooperative seed producer company, Kisan Laxmi Seed Cooperative, in Gadawada village, Jhabua district.

- National Agricultural Innovation Project (NAIP) 2009-2012. GVT is part of a consortium that operates in Dahod district, Gujarat, and Jhabua and Mandla districts in MP. PVS is a component of this programme.
- Research Into Use (RIU) Programme – DFID seed multiplication programme (see below).

At the end of the RNRRS research programmes DFID wanted to take stock of the programmes and distil lessons arising from their aggregate experiences in order to inform future DFID research planning trajectories (Rath and Barnett, 2006)[100]. Rath and Barnett (2006) used an innovations systems (IS) approach, as developed by Arnold and Bell (2001)[101], as a central model in their conceptual framework and analysis of the RNRRS programmes[102]. The IS model can be used by policy makers and analysts as a heuristic tool for trying to understand the tangled web of relationships between stakeholders and organisations trying to carry out innovative research and technology development[103]. However, the IS model is general and open-ended, and in order for it to have any useful effect it needs to be applied to a specific context, i.e. PCI / PPB in India or Nepal. Although Rath and Barnett's (2006) report was meant to involve all the RNRRS programmes, they were unable to interview Dr. Claire Stirling (PSP) and only made mention of the PSP in passing without referencing any of its reports directly. This lack of interaction between the PSP and the authors of the report may have impacted on the authors ability to understand and convey the approach and achievements of the PSP as recorded in the PSP's own review of its experiences (Stirling et al., 2006). The IS model as applied in the RIU to COB, privileged the extension of the COB varieties (innovative products) to farmers through seed multiplication schemes, but failed to support PCI/COB as an innovative *process* or *organisational innovation* and see the methodology of PCI scaled-up with a view to its institutionalisation within research organisations (RIU, 2006). It is debatable

[100] The Rath and Barnett (2006) paper is the 10th RNRRS Synthesis Study.
[101] Arnold and Bell (2001) are critical of the 'linear model' of innovation, that is, basic sciences leads to applied science, which causes innovation and wealth. Under their idea of innovation the 'science push' and 'market pull' mechanics of technology development are described as having the tendency of being counterproductive to innovation as a whole. Instead they present a broader system of innovation that addresses a wider spectrum of stakeholders than the linear model and suggests the presence of multiple linkages between them.
[102] Dr. C. Stirling, a manager of the PSP, was not available for interview in this report, nor was the PSP
[103] Much like the word 'participation', 'innovation' can have a polysemic meaning depending on the context. Innovation in the context of this thesis refers to the application of novel ideas and technologies (inventions) in new/different contexts. The term innovation can refer to products (technologies), processes, and organisations.

whether this was the sole reason for not including a PPB/COB element in the new RIU or whether there were other constraints limiting DFID's promotion of PCI, but in any case PCI was limited to seed multiplication exercises for a few programmes within the RIU.

The RIU Programme was originally planned to run from July 2006 to June 2011, though it was eventually extended till June 2012. The RIU underwent a review process in 2009 and was subsequently restructured. Prior to this the seed multiplication programme featured as part of the RIU's 'Best Bets' initiative – a competitive funding mechanism, the inspiration for which "comes from the successful and popular BBC television programme Dragons' Den"! The latterly re-jigged Best Bets projects focus solely on promising projects within Africa.

After the restructuring of the RIU the seed multiplication programmes came under the South Asia programme, which consisted of the following four themes:

1. Establishing seed delivery systems and promoting capacities for participatory crop improvement.
2. Innovation in value chains
3. Scaling up of natural resource management research products
4. Investing in institutions for rural service delivery.

Within this first research theme on seed delivery systems there are three merged and expanded projects on promoting the products of COB with farmers with the following NGO partners:

- Bangladesh – Prova Seeds
- Nepal – FORWARD and LI-BIRD
- India – CAZS-NR, GVT and Catholic Relief Services (CRS)

The purpose of these projects was to establish companies that can support and upscale the production of new seeds of varieties that have been found to be popular with farmers through PVS and COB methodologies. The companies would "ensure that the capacity to develop and distribute varieties developed in this way remains and even expands after the life of RIU (RIU Website)." The RIU expected a large impact to be generated from the adoption of these varieties and hoped that the lessons learnt in trying to implement this research theme would contribute to DFID's Central Research Team questions on poor user-led and public-private partnership-led innovation.

The activities supported by RIU with respect to COB would do nothing to promote COB within these countries. The projects targeted an important, identifiable research constraint – the multiplication and distribution of the seed of varieties identified through PVS and previously produced through COB. Although the activity had the potential to maintain or slightly increase the initial impact of PVS/COB derived crop varieties, it is unlikely to have any impact on the institutionalisation or expansion of PCI by plant breeders within these countries, i.e. build upon the work of the PSP and WIRFP/EIRFP.

Although the RIU did not provide funds specifically for the COB/PPB, in the case of Nepal, the varieties that were in the pipeline were able to be finished and their production scaled-up with the funds provided to LI-BIRD, a Nepalese NGO and CAZS-NR project partner, by the RIU[104]. As part of the RIU project in Nepal , Community Based Seed Producer (CBSP) groups and private companies – including Global Agritech Nepal Private Limited (GATE) – were set up, and PVS was used to determine farmer preferred varieties and popularise them.

In India the RIU funded a seed multiplication and delivery project involving CAZS-NR, GVT and CRS from January 2010. However, the project only focused on rice varieties and was predominantly based in GVT's eastern India domain[105]. GVT set up a cooperative, the Jagan Nath Seed Producer Company, in Orissa which supplied rice varieties which GVT disseminated within Chhattisgarh, MP and Rajasthan, and the CRS in Uttar Pradesh and Orissa, and through an informal NGO network in Jharkhand (*Ibid*.).

Regarding the potential impact of the RIU projects, John Witcombe expressed his scepticism as to whether the companies and the CBSPs will persist after the RIU funding has finished[106]. Many of the RIU seed-related activities took place from early 2010 and he does not think two years is enough for a donor-supported private company to become profitable and therefore sustainable (*Ibid*.). Moreover, in the case of Jagan Nath Seed Producer Company, the CEO has fallen out with the directors and has left the company, throwing its continued existence and future performance into question (*Ibid.*). Even if the seed producer companies were to be sustainable as a profitable organisation in the future, it is not known whether they will continue with PVS, and they are not currently linked to organisations carrying out PPB/COB.

[104] John Witcombe Interview, Bangor, 9th October 2012
[105] Yadavendra Interview, Dahod, 30th April 2011
[106] John Witcombe Interview, Bangor, 9th October 2012

The future of the production and promotion of farmer preferred varieties through PCI remains in the balance.

6.3.2 The Use and Spread of PVS by NGOs in the Project Area

At the end of the Rain-fed Farming Project in 2007, GVT lacked the funds to refresh its collaboration with the SAUs and had to shed approximately two thirds of its staff, though it still retained Dr. Yadavendra as a crop consultant[107]. Even though GVT was unable to secure enough funding to restart its collaborative breeding with SAUs, it could still make use of a less resource-intensive methodology, PVS. Post-WIRFP there were two large development projects which allowed for the use and spread of PVS by NGOs within MP: the World Bank funded District Poverty Initiative Project (DPIP) and the DFID funded Rural Livelihoods Project (MPRLP).

The use of PVS by NGOs and public sector organisations, such as SAUs, has been recorded in Czech Conroy's (2009) impact assessment on PCI in India. In the report he presents a series of tables documenting which organisations have carried out PVS, on what crops and in what states (*Ibid.*) (*Cf.* Tables 18-21 below). Most of the PVS activities listed in the tables refer to the time when GVT was engaged in the WIRFP and EIRFP; and the SAUs listed in Table 18 no longer carry out any PVS activities opting instead to stick with their standard extension systems.

Table 18 - Public Sector Organisations Involvement in PVS, by Crop

Organisation	Maize	Upland paddy	Black gram	Chick pea	Horsegram	Niger	Pigeon pea	Soybean	Wheat
MPRLP	✓	✓	✓	✓	✓	✓			
MPDPIP	✓	✓		✓			✓	✓	✓
SAUs									
GAU/AAU	✓	✓							
JNKVV/RVSKVV	✓	✓	✓	✓	✓	✓			
RAU/MPUAT*	✓	✓	✓	✓	✓				
GAU/SDAU*			✓						
BAU*	✓	✓							

* No data received directly from this university – details provided by DR. JP Yadavendra

Source: *Conroy (2009a)*

[107] Yadavendra Interview, Dahod, 30th April 2011

Table 19 - NGO Involvement in PVS by Crop: Staples and Coriander

Agency	CROP				
	Maize	Upland Rice	Pearl Millet	Wheat	Coriander
ASA	✓	✓	✓	✓	✓
GVT	✓	✓		✓	

Source: *Conroy (2009a)*

Table 20 - NGO Involvement by Crop: Legumes

Agency	CROP								
	Blackgram	Green gram (Moong bean)	Horse-gram	Soybean	Chickpea	Ricebean	Pigeon pea	Niger	Rapeseed mustard
ASA	✓	✓		✓	✓		✓		
GVT	✓	✓	✓	✓	✓	✓	✓	✓	✓

Source: *Conroy (2009a)*

Table 21 - NGO Involvement in PVS by State

NGO	Gujarat	Rajasthan	MP	Jharkhand	Orissa	Bihar	West Bengal
ASA	✓		✓	✓		✓	
GVT	✓	✓	✓	✓	✓		✓

Source: *Conroy (2009a)*

Conroy's report (2009) chronicles two NGOs who have carried out and institutionalised PVS as a core approach within their methodologies competencies: GVT and Action for Social Advancement (ASA). These NGOs have acted as partners and introduced PVS to different development projects largely in MP, but to other states as well. The formation of ASA and its adoption of PVS were closely linked with the association of key staff members with GVT, DFID

and CAZS-NR. ASA was founded in 1996 by Mr. Ashis Mondal who had previously been a staff member of the KRIBP. The NGO has its head office in Bhopal, MP, and focuses on semi-arid regions and poor/tribal farmers, in a similar manner to GVT. ASA's approach to development is based around five themes: land and water resources development; agriculture productivity enhancement; agribusiness promotion for small holders; institutional credit for agriculture; and, research and training consultancies. Mr. Mondal was a former colleague of Mr. Arun Joshi who had left WIRFP to work for KRIBHCO in Andhra Pradesh for three years. Mr. Joshi subsequently joined ASA and helped introduce and make PVS an integral part of ASA's agriculture productivity enhancement programmes (*Cf*. Pastakia (2011) for a more detailed case study on ASA's PVS work).

Although the first phase of MPDPIP started in 2001, ASA was invited in 2003 to provide a small consultancy team to analyse and provide support for its agriculture programme. After an initial PVS pilot phase ASA managed to convince MPDPIP to incorporate PVS in all of its 14 project districts from 2003 until 2008[108]. As part of the MPDPIP ASA trained other NGOs to carry out PVS sensitising perhaps 50-60 NGOs to the merits of PVS, although it is uncertain how many if any use PVS within their development programmes[109]. ASA had a consultancy role for the second phase of MPDPIP (October 2009 onwards) and produced a number of manuals on Farmer Producer Companies (FPCs) – a central approach to the MPDPIP and ASA's approach to PVS (Mondal et al., 2010). Under the MPDPIP FPCs operate at the district level and were formed out of the Common Interest Groups (CIGs) that DPIP helped set up at the village level. As experienced under the WIRFP, when PVS is carried out over a large scale the demand for seed cannot be met through public sector channels. One of the main purposes of the FPCs is to carry out certified seed production activities of farmer-preferred (PVS) varieties, utilising the CIGs that make up their shareholders. However, their purpose is also to be financially profitable and for this reason they also carry out other functions including: input supply, marketing, contract farming, credit, and insurance, etc.. FPCs represent an iteration of community-based seed producer groups, and ASA's hope is that this model is more sustainable than those which have been attempted in the past.

[108] Arun Joshi Interview, Ratlam, 8th March 2011: Project team consisted of Arun Joshi, Ashis Mondal and Yogesh Dwivedi. The PVS programme was the biggest of its type in MP at the time.
[109] Yogesh Dwivedi Interview, Bhopal, 18th March 2011: it is not possible to verify the exact number of NGOs that have been "exposed" to PVS. NGOs specifically mentioned by Dwivedi include Pradan, N. M. Sadguru Watershed Development Foundation (SWDF),

ASA has repackaged PVS under the slightly different name of Participatory Varietal Selection and Promotion (PVSP). According to Mondal, PVSP takes PVS "full circle" through setting up FPCs as clients for future rounds of PVS[110]. If the FPC model is sustainable it may be possible for ASA to provide PVS support to the companies. In this manner the FPCs and NGOs can act as intermediaries filling a gap and strengthening the links between the public and private sectors and the farmers they claim to serve.

GVT had a more modest role in its engagement with MPRLP than ASA had with MPDPIP. GVT carried out PVS under MPRLP only in Jhabua district for a period bridging the end of the first phase and the start of the second phase (2006-08)[111]. At the end of the first phase of the MPRLP Arun Joshi was hired as a consultant to evaluate the farming systems aspect of the project and questioned why PVS was not being replicated across the whole project[112]. Along with Peter Reid (FAO) he also formed part of the project design team for the second phase, but there were disagreements between Joshi and members of the team regarding the role and use of PVS in MPRLP (*Ibid*.). Essentially PVS was not a significant part of the MPRLP – it does not feature in any project documentation, and two MPRLP staff interviewed knew very little about it, despite having previous knowledge of the WIRFP and PVS in that context[113]. These experiences suggest that the NGOs had difficulty in institutionalising PVS within MP state's development programmes.

Early on in their interaction with MPDPIP and their promotion of PVS, ASA was confronted by an Indian Administrative Service (ISA) officer who questioned the legality of PVS. ASA had to draw up a PVS protocol which was duly circulated around the MP SAUs, relevant government agencies and the Principle Secretary for comment, before it was subsequently accepted and published by DPIP (Conroy, 2009a:29-30). Although PVSP has been carried out in all 14 project districts under DPIP, PVSP is not found within that project's Project Appraisal Document. In both the MPRLP and MPDPIP PVS was used as a tool by NGOs providing technical support – it was an auxiliary method that was complimentary to the goals of these projects but was not incorporated within them as part of their *modus operandi*.

[110] Ashish Mondal Interview, Bhopal, 18th March 2011
[111] Yadavendra Interview, Dahod, 30th April 2011
[112] Arun Joshi Interview, Ratlam, 8th March 2011
[113] Mr. Shazad Khan (Technical Advisor, MPRLP) and Mr. Duncan King (Senior Manager, MPRLP) Interviews, Bhopal, 21st March 2011

Both the MPRLP and MPDPIP operate in different districts in MP focusing on scheduled tribe and scheduled caste dominated areas respectively. The project outlines are essentially similar to each other in that they aim to link Self-Help Groups (SHGs), aka Common-Interest Groups (CIGs), to an already established local governance system - the *panchayati raj*, through strengthening local institutions such as village councils (*gram sabha*). Both projects channel funds via project facilitation teams (PFTs) to the SHGs in order to support their bottom-up development plans. The RLPs and DPIPs do not adopt the language of 'participatory development', but nevertheless share similarities in the approach that was pioneered under KRIBP and WIRFP/EIRFP. These new iterations of the previous development projects aim to sustain the institutions (SHGs) they set up through 'convergence' – that is linking SHGs to existing sources of funding found in GoI schemes such as provided by the National Rural Employment Guarantee Act (NREGA), *inter alia*[114]. In the case of MP 'convergence' also occurs at the state level at the State Learning Forum, which seeks to provide a platform where development projects and the state Panchayat and Rural Development Department and concerned parties can discuss and where appropriate integrate the lessons from and approaches used by different development projects.

As of June 2011 a new national rural livelihoods development schemes has been launched under the title of the National Rural Livelihoods Mission (NRLM). The NRLM is partially funded by the World Bank and has used the experiences of DPIP, MPRLP and a previous GoI scheme, SGSY, as its basis. The NRLM has a core blue-print plan that is imposed on 13 high poverty states. Under the NRLM Project (NRLP) each state has some leeway in drawing up a State Prospective and Implementation Plan (SPIP) on how they will implement the project. MP's SPIP does not mention PVS but there may be the potential for NGOs to implement it at a later date. However, without process champions such as ASA and GVT, PVS is unlikely to feature in other states implementing the NRLP where they do not have a physical presence.

Contrary to Conroy's (2009) impact assessment, it seems that the PVS approach has not been significantly integrated within either MP's agricultural R&E or development systems. Despite having been widely employed within development projects in MP, PVS has failed to be adopted within the core structure of rural development projects, although it has supposedly

[114] Duncan King Interview, Bhopal, 21st March 2011

been officially recognised as a potentially useful way in raising single factor productivity under rain-fed agricultural farming systems[115].

To the best of my knowledge there has not been a negative critique of PVS published in India or under any of the development projects in which it has featured. This suggests that the failure of PVS to be fully incorporated within development projects such as the MPDPIP and MPRLP stems from the positioning of the process champion NGOs (ASA/GVT) on the periphery of these projects as contracted technical consultants. Despite providing critiques and calling for the use of PVS, the NGOs were unable to translate the PVS activities that they promoted into development policy. This is despite PPB and PVS being written about favourably in a Word Bank background paper (*Cf.* Walker (2008)).

However, Ellis and Biggs (2001: 444-445) have suggested that newer approaches to rural development based around a 'sustainable livelihoods' framework may challenge *Farmer First* approaches since, agriculture only corresponds to 40-60% of rural household incomes. The combination of sustainable livelihoods policy being directed from above and PVS from the periphery are unlikely to have created conditions where PVS is fully integrated and institutionalised within these development projects.

Finally, both ASA and GVT have used PVS in the MPRLP and Bihar Rural Livelihoods Project (BPRLP) respectively, but this too has failed to translate into the incorporation of PVS as policy within the Rural Livelihood Projects. This constitutes a failure of DFID to capitalise on a methodology that had been developed and tested for efficacy under its previous WIRFP/EIRFP projects. Although the RLPs started towards the end of the WIRFP/EIRFP and PSP and had continued over the duration of the RIU, there are no direct links between the RIU and DFID-India development projects[116]. This represents a missed opportunity for the RIU to scale-up the products of the PSP and associated schemes within more current DFID projects through promoting PVS as a method and supporting the creation of CBSPs/FPCs within the RLPs, in a manner similar to MPDPIP. The broad research network (PCI niche) that had been formed during KRIBP, WIRFP and the PSP could have been better supported after the end of these programmes. However, it took Witcombe and Joshi much effort to initially convince DFID to pursue plant breeding research activities within KRIBP, and plant breeding research has been increasingly marginalised within DFID subsequently.

[115] Yogesh Dwivedi Interview, Bhopal, 8th March 2011
[116] Duncan King Interview, Bhopal, 21st March 2011

6.4 Limited Mainstreaming of PCI

So far this chapter has dealt with how the WIRFP and associated organisations characterised their success immediately after the end of the projects and what their activities and achievements have been in the subsequent period up to the present day. In this section I reconsider the collaborative research that took place between the PCI projects and the public sector research system and how the nature of these interactions contributed to the limited mainstreaming of PCI within the latter. In particular I discuss the rules, norms and interests which govern the varietal testing and release pathways and how they act as a major bottleneck to the adoption of PCI, before considering why the project failed to alter scientific praxis within the SAU organisations that it partnered with.

6.4.1 Engaging with SAUs and Negotiating the Varietal Trials Pathway

It is important to restate that KRIBP was first and foremost a development project working on tribal, rain-fed agricultural research systems. Its inception corresponded with the start of a burgeoning epoch marking a period of heightened experimentation and development of farmer participatory methodologies. As such, PCI was in the process of being tested and developed while also being a part of a larger development project. The project's crop programme necessarily had to work within this context and was faced early on with a choice to engage with the public plant breeding system and form a partnership with it, or work alone. The KRIBP crops programme decided to engage with the public sector because the private sector would not have supported the breeding and multiplication of varieties for tribal farmers, and it did not have the experiential capital to leverage funds from the project and DFID in order to carry out a large scale breeding and multiplication programme itself. Instead it opted to form partnerships with SAUs, within or bordering the project locale, in order to benefit from efficiencies brought about through harnessing their infrastructure and staff. The SAUs are also intimately linked to the varietal release process in the state and so, as Witcombe has argued, interacting with them was essential in order to get varieties sanctioned, released and multiplied.

Prior to reaching the State Varietal Release Committee (SVRC), candidate varieties are discussed at the seasonal ZREACs where R&E staff deliberate on their merits according to the

VCU and DUS criteria. The ZREAC deliberations can be a stumbling block because the variety is discussed among research staff who have not been sensitised to the PCI methodologies. These staff have their own shared professional norms regarding what data are sufficient to support the approval of a candidate variety. Although WRIFP crop programme staff were invited to ZREAC meetings there were quite often hard negotiations regarding approving the project varieties. There are two instances of particular note. The first involved the GM-6 candidate variety, the project's first PPB variety to be released and arguably its biggest success in India. GM-6 was delayed at the AAU ZREAC level several times with requests for more information on its performance. Part of the problem was the presence of non-university staff names (Joshi and Witcombe) appearing on the varietal identification *proforma*. The project managed the delays through generating more data on the candidate variety's performance, as well as applying pressure on the Director of Research by suggesting that future MOUs might be withheld if the product of the first phase MOU was not successful[117]. This suggests that much handholding was needed for the PCI-derived varieties to pass through the testing system. The second instance of note occurred during the first phase between the project and scientists at RAU. In this case the project was trying to get Kalinga III released in Rajasthan – a rice variety that had proved popular with project farmers under PVS. However, at the same time as Kalinga III was being pushed by the project, RAU had developed what it thought to be a similar variety that it wanted to release. Understandably the RAU scientists favoured their variety despite Kalinga III proving to be the more popular with tribal farmers under PVS[118].

This resistance to PCI varieties and methods took place at different SAUs and at different times and reinforces the idea that the type of collaboration that occurred between the development project and the SAUs was different from, and in addition to, the universities' conventional mode of research. Although universities have the potential to carry out research funded by outside agencies, these types of projects essentially take place behind a 'firewall', externalised with regard to their conventional research practices. This type of relationship greatly limits the project's potential for altering normative R&E practices at the universities.

One of the reasons for initially working with the public sector was to get varieties officially released with the aim that they would be supported and spread via the extension departments of the SAUs and the state. As outlined earlier in the chapter, many of the PCI varieties are no

[117] Dr. Witcombe Aide Memoire September 2000: he states that the case for release was overwhelming and there were no scientific reasons for it to have not been identified at the meeting.
[118] Daljit Virk Aide Memoire Nov/December 1995

longer supported by the universities and the seed is no longer available: for example, Witcombe could not find any seed of the COB horsegram variety that had been bred under WIRFP for use in the RIU project. In many Indian states the seed multiplication system is in need of a complete overhaul to address problems in production, supply and dissemination, and accurately assessing demand (Yasin et al., 2006). Even a well implemented 'rolling plan' for assessing seed demand can take five years from receiving a demand assessment before the seed can be sufficiently multiplied and disseminated for distribution (*Ibid*.).

A cyclical problem can occur with newly released varieties in the public R&E system – in order to market and promote new varieties there needs to be enough seed available, and in order for new seed to be produced there needs to be recorded demand in the form of invoices (indents) from sellers. If a new variety is not actively promoted by the extension system it is very easy for it to remain a 'paper release', and even if it is promoted it can take up to 10 years to be popularised and reach farmers in the quantities that they need. The shortcomings of many state's seed systems require the active and sustained promotion of varieties at the university level. Without this level of support the chance that varieties will not be promoted is greatly reduced. Since many of the PCI varieties were released towards the end of the WIRFP second phase, there was not enough time for handholding to make sure that they would enter the extension system and be promoted.

The only PCI variety that has been officially released and actively promoted by the public research system is GM-6 maize, which was released by AAU in Gujarat in 2001[119]. It is undoubtedly one of the biggest success stories of the WIRFP crop programme since it has been multiplied even after the end of the project. GM-6 is maintained by AAU and multiplied, in part, by the Gujarat State Seed Corporation (GSSC) for the ISOPOM – a federal government seed distribution scheme. In 2012 Witcombe commissioned Yadavendra to carry out a study on GM-6 and the current status of its seed production[120]. Witcombe plans to use this information in a comparative case study alongside Ashoka 200(F), whose seed multiplication was supported through the production of CBSP groups under the RIU programme, in order to demonstrate the two different seed production models[121]. GM-6 may have benefited from being the first PCI variety released via the project early on in its first phase (April 2001). It may

[119] Prof. Billore has helped the release of IVM-421 in MP, although I was unable to get figures on its seed production. Information supporting this comes from Witcombe and Yadavendra interviews and the GSSC website.
[120] John Witcombe Interview, Bangor, 9th October 2012
[121] John Witcombe Interview, Bangor, 9th October 2012

have therefore had more time than the other released PCI varieties to be actively incorporated within the extension systems of the university and wider state. There may have been other contributing factors to the maintenance of GM-6 by the public sector. Maize is a staple crop and GM-6 was bred to target a distinct niche for which there were no appropriate varieties. However, what is known from the experience of many of the PCI projects is that official release does not automatically guarantee the maintenance and spread of the variety within the region it has been recommended for. Future PCI projects working with the public sector should make time available for popularising PCI varieties with the extension staff of the university they are collaborating with.

6.4.2 Failure of PCI to Alter Scientific Praxis

The MOUs meant that the research staff at the three agricultural universities were exposed to and sensitised to PCI methods. However, this did not translate to an altering of the R&E scientific praxis at any of the SAUs. Through visiting AAU, MPUAT, RVSKVV, some of their research stations and KVKs and the national maize, rice and soybean crop directorates, I was able to better understand why these methods have not permeated further within the Indian NARS. In this section I consider GM-6 and trace the opinions of plant breeders at the research station (Godhra), main university campus (AAU) and the national-level organisation – the Directorate of Maize Research (DMR) at Pusa, in Delhi. From talking to plant breeders at these different organisations it became clear to me that some plant breeders and research scientists maintained some reservations concerning the PCI methods; thought that the problems that PCI was trying to address were already dealt with under the current R&E system; and that in the case of the DMR, varieties such as GM-6 are outmoded and should categorically not be bred.

At the Maize Breeding Research Station at Godhra I discussed GM-6 and maize breeding with two plant breeders, Dr. Khanorkar, who worked on GM-6 and is named on its release proposal, and another plant breeder who had not been involved in the project. Khanorkar started by mentioning that GM-6 is a popular variety and its qualities have made it popular within the tribal region[122]. However, he explained that no maize varieties were currently bred for the tribal regions of Gujarat. Instead the research station's agenda was focused on producing single-cross hybrids for industrial production of high fructose corn syrup (HFCS), quality protein

[122] Khanorkar Interview, Godhra, 28th April 2011

maize (QPM), and novel popcorn and sweet corn varieties. Although these were nascent industries and markets which were not well established in Gujarat, local cities were seen by the university as potential new markets for these varieties (*Ibid*.). He said that a number of industries had approached AAU requesting these varieties and that the university had provided them with information on potential contract farmers, another growing phenomenon. With respect to the tribal belt, Khanorkar claimed that only a few farmers had started adopting these novel varieties and that more time was needed to popularise them.

Although he was generally positive about what had been achieved by the COB/PCI programme, he had a few criticisms of the methodology, principally with its precision and accuracy. He thought that working with farmers produced *many* sampling errors; that human resources were a significant constraint in carrying out PCI; and that farmers and scientists were unable to maintain proper isolation distances on the research station and in farmers' fields affecting the quality of seed production. It was not clear from the interview whether he thought that PCI could be used as a market research tool (PRA) for understanding market, industry and farmer preferences for the SAU's new breeding agenda. When a crop is grown for industrial purposes, factors such as taste, grain type and fodder quality are not as important as for when it is grown for local markets or under subsistence conditions[123]. However, it seemed that Dr. Khanorkar did not see PCI as a means of orienting research towards clients (farmers, markets, industry) beyond how he had used it previously in the context of tribal farming systems.

At the main AAU campus alongside Yadavendra I met with AAUs Director of Research, Dr. K. Khataria, the Associate Director of Research, Dr. M. Pathak, and Dr. Atul Mehta, a senior rice breeder who had been involved in an MOU with GVT on COB. They made efforts to explain how over the past 10-15 years farmer involvement in R&E work at AAU and Gujarat in general had increased at all stages from representation in research council meetings to evaluating plant material[124]. Khatiria mentioned that it was often the case that farmers visit and evaluate advanced, unreleased plant material on research stations and that this information is included within research proposals where previously it was not. Compared to Rajasthan and MP, the scientists described Gujarat as being one of the best and well supported states for agriculture and research in India. There are approximately 60 research stations in the state with roughly eight per ACZ. Moreover, Gujarat runs a novel month long Farmer Celebration (*Krishi*

[123] Directorate of Soybean Research (DSR) Focus Group Discussion, 4th May 2011
[124] 'Progressive' farmers are present at ZREAC, University Reseach Councils and State Agricultural Research Councils.

Mahotsav), which has been operating for eight years. The purpose of the celebration is agricultural technology dissemination and education and involves multi-disciplinary teams of scientists visiting every village in the state. The Directors of Research stressed that the current system of research and extension includes regular representation of farmers on committees and that scientists do their best to incorporate farmers' needs in their breeding programmes. When asked about the role of PCI they did not feel that it was necessary with all the other initiatives the universities were doing to include farmers, and PVS was singled out as being expensive due to having to compensate farmers for the land they use.

Mehta had a far more favourable impression of PCI on account of his project experiences. He advocated the approach along the same lines as it was carried out under WIRFP. He emphasised that although the state has a good network of research stations, the problem with poorer farmers in relation to the research system is that they are largely immobile and therefore unable to visit research stations and KVKs and make their opinions known to scientists. Moreover, he claimed that scientists are unable to visit these farmers on account of time and manpower constraints. He cited his constraints as managing the breeders seed multiplication programme, breeding work itself, carrying out 750 FLDs (in rice), Farmer's Days, meetings, teaching, and administrative work, etc. Even if he were to visit farmers he said that it would at most be a one-off activity which would not be helpful for determining farmer preferred crop traits. Instead, he proposed that NGOs and or KVKs should maintain contact with a few villages and facilitate farmer visits to research stations to evaluate material and *vice versa*. He was sceptical of the ability for time-limited projects to be able to create a good PCI breeding programme because sustained interaction allows for farmers to be educated and sensitised to the benefits of more complicated plant breeding methods and their benefits (*Cf*. Qualitative Trait Loci (QTL) / Marker Assisted Selection (MAS) etc.). Although Mehta solicits information from farmers when they visit his research stations, he is aware that this does not target the poorer farmers who are less able to travel. He thinks that it should be within a KVKs mandate to maintain close links with poor farmers and that funds should be made available by the central and state governments for this purpose. This idea is discussed further in the next chapter as it may provide a mechanism for improving the client-orientation of agricultural research.

At the national level the current and previous head of the DMR, Dr. S. Dass and Dr. S. Kumar, are responsible for the maize AICRP[125]. Both directors discussed their research agenda as breeding single-cross hybrids, QPM, and novel babycorn, sweetcorn and popcorn varieties. This research agenda closely mirrors that mentioned by Khanorkar at AAU showing the reach of AICRP in informing crop-specific research agendas across the country. The principle component of the maize research agenda is a focus on single-cross hybrid maize varieties – which began in earnest from 1989, replacing OPVs which the directors described as "not scientific" and requiring "low technical skill" to develop. They extoled the single-cross hybrid as being a panacea for *all* of the Indian farmer's woes – increasing single-factor productivity; allowing for greater mechanisation; cost saving; labour saving and yield increases that dwarf what can be achieved with OPVs. According to the directors, single-cross hybrids are universally accepted and appreciated by *all* farmers in India, and if they are not currently grown by them it is only because they do not have are not aware of their potential or do not have access to seed, i.e. extension failings. The directors believe that only the best varieties reach farmers and that the current testing and legitimisation process produces varieties that are completely acceptable to farmers. They did not acknowledge the role of poverty in the decision not to adopt new varieties, arguing that the seed is relatively cheap and can give a good return on the farmer's investment.

The directors were sceptical of the role of NGOs and the funding they received with respect to agricultural activities. When I tried to discuss PCI methods with them they were scathing of PVS saying that FLDs selected the best variety to demonstrate to farmers. They could not see the benefit of handing them a "basket of choices" and were concerned about the introduction of inferior varieties susceptible to pest and diseases, and that the whole process was a waste of money that could be used elsewhere. Moreover, they were hostile to GM-6 since it was a retrograde OPV and questioned the science, rationale and integrity of the scientists behind it.

All SAUs are exposed to the research agenda outlined by the different ACRIPs and crop directorates. The SAUs are able to pursue their own research agendas, but are likely to adopt the AICRP-mandated agenda if AICRP funds constitute a significant proportion of their research budget. However, even a comparatively well-off state such as Gujarat carried out maize research on the topics and types of maize advocated by the DMR. In the case of the DMR, the directors were overtly hostile to FPR and PCI methods, and this has undoubtedly had an

[125] Directorate of Maize Research (DMR) Interview, 19th May 2011

influence on maize breeders throughout the country. Conroy found similar evidence of the influence that the ICAR system exerted on SAUs with regard to adhering to a centrally prescribed research agenda:

> "The Vice Chancellor of an SAU could discourage his/her university's plant breeders from being involved in PPB is (s)he was aware of the ICAR HQ attitude and was worried about the implications for university funding from ICAR. In one case ICAR's ADG Crops is reported to have told Birsa Agricultural University (BAU) to stop working on PPB, which he considered to be a waste of time, and to have threatened to stop ICAR grants to BAU if they continued." (2009:32)

These two examples suggest that ICAR technocrats can exert significant influence over SAU research agendas. The staff occupying the top positions in ICAR institutions are products of the research system they have worked in for their professional careers. They support a narrow research agenda that promotes what they consider to be the best varieties and technologies, rather than a graduated agenda which prescribes different technologies for farmers facing different agricultural and livelihood scenarios. They consider 'appropriate' and 'intermediary' technologies such as OPVs an anathema since they are outmoded and seemingly produce fewer benefits than more modern hybrid technologies. Both the narrow and graduated research agendas require a strong extension delivery system, and in the absence of one these counter arguments remain undecided.

Other than the constraints imposed by the management and institutional hierarchies within which they work, plant breeders raised a number of broader issues to do with PCI methods. In the example of GM-6 both manpower and cost were raised as major issues to carrying out PPB and PVS activities[126]. There is not much leeway within SAU research budgets to carry out work that does not utilise the efficiencies afforded through the use of their pre-existing institutional infrastructure, such as research stations. Any trials or breeding carried out on farmers land would incur greater costs than current programmes in terms of transport of staff and compensation for using farmers' land. Both Khanorkar and Gaur (ICRISAT breeder) mentioned that PCI trials on farmers' land had to be replicated on the research station in order to provide appropriate scientific data to allow the variety to pass through the state varietal release system. This duplication of effort is an extra cost in terms of land used and manpower that

[126] This view point was held by multiple scientists: Prof. Billore, RVSKVV; Dr. Atul Mehta, AAU; Dr. Khanorkar, AAU; Dr. Yadavendra (ex-AAU); Dr. D. Sherma, RVSKVV and scientists from MPUAT

was born by the project. Many of the potential advantages of PPB in terms of reduced cost and time till variety release fail to materialise when conducted in the Indian NARS.

A number of plant breeders expressed concern in sharing unreleased advanced material with farmers, as in the past it had been acquired by the private sector[127]. This spectre of 'biopiracy' undermined the spirit of cooperation that is needed between scientists and farmers in order to carry out PVS. Mehta suggests that if there were an ongoing relationship between NGOs and KVKs a rapport could be established leading to the sharing of more advanced materials[128]. In spite of these issues Prof. Billore, a RVSKVV and COB chickpea breeder, argued that PVS should replace FLDs in the Indian NARS.

Finally, one of the largest hurdles in overcoming normative scientific praxis is that many plant breeders believe that their work is already 'farmer participatory'. This is exemplified by extension staff at the Directorate of Rice Research (DRR) who thought that the FLD process was 'participatory', when in fact it is a scientist prescribed demonstration[129]. Central to the PCI narrative is the idea that by working closely in partnership with farmers, plant breeders can create better varieties by taking into account farmer-preferred traits. However, as Gaur states[130],

> *"I don't know why people get this understanding that breeders work in isolation so they don't work with farmers. But because I am a breeder from the very beginning, and I have seen in my university also, the breeders work very closely with farmers everywhere. They interact very much, and they discuss with them their requirements. Then only they have priorities in their breeding programmes."*

This was a view that was supported by many plant breeders. Many would talk about how they saw farmers at their research stations; that they would make seasonal trips to farming villages close to research stations; that they would receive information on farmer problems via extension staff; and, through FLDs and farmer field days[131].

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[127] Billore Interview, Indore, 17th March 2011 and Dr. Mehta Interview, Anand, 27th April 2011
[128] Mehta Interview, Anand, 27th April 2011
[129] DRR Interviews, Hyderabad, 13th May 2010
[130] Gaur Interview, Hyderabad, 14th May 2010
[131] Dr. A. S. Hari Prasad, Senior Scientist (Hybrid Rice) DRR and Dr. R. M. Sundaram, Senior Scientist (Biotechnology) (DRR) Interview; Dr. Diness Sherma (RVSKVV) Interview

PCI advocates see the situation differently. Joshi viewed the strict bureaucracy of the Indian NARS as a "fool's paradise" where there are low seed and varietal replacement rates but no formal mechanisms and adoption studies to assess the appropriateness of the plant varieties produced[132]. Mondal similarly cites a lack of accountability within the research fraternity as a structural problem which maintains the research *status quo* and offloads blame to the extension system[133]. Regardless of the structural issues constraining the use of PCI in SAUs, it seems that the way in which PCI was structured and carried out did not yield significant enough improvements for plant breeders to take them up and alter their research practices. Moreover, it seems that tribal, CDR farmers are not specifically targeted or acknowledged as being different to progressive farmers by the research system for the breeding of new varieties.

6.5 Discussion

Sub-Research Question 3:

> *Have there been any lasting socio-technical translations between the PCI niche and plant breeding regime, and what are the implications of this for other PCI projects and programmes?*

This discussion revolves around answering the third research question above. Smith (2007: 444) cites a number of different socio-technological translations that may take place between niche and regime linked to: learning; institutional embedding; regime tensions; and, niche regime linkages.

With respect to 'learning' the PCI niche evolved around a critique of conventional research and how it excluded certain types of farmers in its research processes. Although the PCI niche was able to sensitise some individuals in the Indian NARS, its prescription of greater client-orientation and farmer participation did not translate well to researchers within the prevailing regime. In part this was because actors within the regime felt that their current research system actively solicited information from progressive farmers so the PCI critique did not hold much weight.

[132] Arun Joshi Interview, Ratlam, 8th March 2011
[133] Ashis Mondal Interview, Bhopal, 18th March 2011

In terms of 'institutional embedding' we have seen that the *technological configuration* of PCI methods was packaged in such a way that it worked well given external funding to overcome manpower and cost constraints that would otherwise prohibit SAUs from carrying out PCI work. Throughout its evolution the niche formed a strong *social-network* which allowed for project funds to be channelled to project partners. Gradually, as DFID funding has decreased, niche partners such as GVT and ASA have had to alter their approach and focus more on PVS activities. They have managed to carry out many PVS trials, but were unsuccessful in institutionalising it as a core rural livelihood methodology within any of the development projects that they have been involved in. PVS is an important element of these NGO's portfolio of development methodologies; however, its continued use is dependent on there being suitable projects for it to be used in. As Yadavendra is retiring from GVT soon, the future use of PVS by this NGO is uncertain.

'Regime tensions' are a significant part of the Multi-Level Perspective (MLP) model within SNM. Tensions may be exerted on the regime by the niche or from wider landscape events. They represent opportunities for the socio-technical regime to reconfigure itself and incorporate aspects of the niche. The Indian NARS appears to be particularly resilient to external pressure of the kind that the niche can exert through its critique of the NARS' R&E practices. A lack of accountability mechanisms for scientists and extension staff and information on the direct causes of poor seed and varietal replacement rates means that multiple explanations for low adoption rates of technology can persist.

Finally, what have been the translations brought about through 'niche-regime' linkages? Other than sensitising a few individuals within the Indian NARS there are no instances where aspects of the NARS have *adapted lessons* from the niche and used them to alter the mainstream scientific praxis. Conversely, interaction with the Indian NARS may have contributed to Witcombe altering his PCI terminology away from farmer participation towards client-orientation (*altering contexts*). In terms of its legacy the niche has created a volume of peer-reviewed work documenting various aspects and potential benefits of including farmers directly within the research and evaluation process. The niche has also generated a global research network, and members of the South Asian niche have interacted globally with other PCI practitioners in what could be termed a loose global niche. However, despite the friendships and professional relationships that have developed, the continued functioning of the research network requires funding for new research projects.

The evolution of PCI within the context of the project and the wider global niche gradually formed into a critique of conventional plant breeding and R&E activities. The second phase of WIRFP planned for more collaboration between the project and SAUs, but also made provisions for the scaling-up of project outputs and benefits to more CDR farmers through the "influencing of policy" (Component D), though, as mentioned above, this was never actively planned and implemented. With respect to the crops programme, 'Component D' represented an amalgamation of the general second order critique of PCI *vis-à-vis* conventional plant breeding, and a desire held by project staff and DFID to see the benefits of the project scaled-up and sustained. However, this desire was incongruent to the nature of collaboration between the project(s) and SAUs as codified in the various MOUs.

The MOUs represent an agreement between the KRIBP/WIRFP/EIRFP and SAUs regarding the nature of their collaboration. The funding provided to the SAUs helped to mitigate the extra burdens they had to bear in carrying out the collaborative project such as the provision of dedicated staff to monitor and carry out the projects and transport so that they could visit the project areas. Yadadvendra argued that the project provided "sufficient but not significant manpower or financial help"[134]. However, this is only ostensibly the case since GVT and the project provided the organisational infrastructure and presence within the tribal areas that the SAUs do not normally have access to, and these costs are not included within the MOU. Without the committed and sustained funds of a development agency the relationships formed between SAU, NGO and farmer was not maintained.

I have used SNM as a conceptual model to better understand the economic viability and socio-institutional embedding of new plant breeding methods and varieties(new technologies) within the Indian NARS (socio-technical regime) (*Cf*. Romijn *et al*. (2010)). A central concept of the SNM model is the formation of a 'market niche' for the technology before it is later incorporated into the mainstream market. In the conceptual framework I posited that the market niche was not a necessary component of the model when applied to PCI, as PCI already considers the needs of end-users (farmers), though it would need to consider the needs and constraints of plant breeders were it to be adopted by them in their research. The WIRFP allowed for collaborative research to occur between development project and SAU by minimising the constraints that plant breeders would otherwise face in carrying out PCI

[134] Yadavendra Interview, Dahod, 30th April 2011

methods in the midst of their other research activities. However, this 'projectised' and time-limited form of PCI meant that these constraints were only temporarily diminished, only to return when project funding and the collaborative relationship ended.

This is a major limitation to PCI as carried out under a development project setting rather than as part of a longer term research programme. Project forms of PCI have been overly reliant on development agency funding which tends to privilege development interventions over research activities. In the context of WIRFP, PCI featured as part of the project but was not the sole focus. Similarly, PVS featured as part of the DPIP and RLP but was not a core component. Project sustainability of PCI initiatives needs to be a central concern for future PCI projects or programmes. Only one COB variety (GM-6) was successfully multiplied and disseminated by the public sector. This illustrates that the public sector cannot be relied on to maintain the varieties after the project has ended. Although ASA and GVT have helped develop CSPGs and FPCs the sustainability of these ventures in terms of the continued production of CPB/PVS varieties and PVS methodologies remains unknown. Future PCI projects need to give careful consideration to how they can sustain the varieties they produce and how they are funded. Short-term projects are very unlikely to be able to alter plant breeding regimes, particularly in the case of India.

Throughout this chapter we have seen the political-ecological and geographical considerations of space, time and power interact in ways that have conditioned the achievements of the niche and whether they have been able to be sustained over time. One of the key temporal-spatial considerations is in the potential of development projects to be ephemeral constructs. Networks of actors may persist and colleagues may still keep in touch, but the shared resources and objectives driving the project may disappear leaving little physical in its place.

Finally, the issue of power, whether it is considered as the ability to change the boundaries of permissible social action, or the ability of one actor to bend another's will, it remains the case that there are powerful actors and gatekeepers within the Indian NARS. It is these people that need to be engaged if strategic and organisational change is to be achieved. However, in the case of research or development projects, it is not necessarily known what change may be needed at the beginning of the project. It is therefore important to undertake investigations into the institutional structures and cultures of potential project partners while maintaining a project structure that can adapt to this information as needed.

The next chapter discusses whether PCI institutionalisation is an achievable goal, given the structure of and relationships between the niche and the regime.

7 PCI Institutionalisation: An Achievable Goal?

7.1 Introduction

Core Research Question:

> *"What are the critical institutional and policy factors that govern the continued co-existence and contestation of participatory crop improvement initiatives with the formal crop improvement regime in India, and that have prevented these participatory crop improvement approaches from being scaled-up and institutionalized?"*

This chapter reflects on the socio-technical characterisations of the niche and the regime presented in the previous chapters to examine the reasons behind the continued contestation and co-existence of PCI methodologies; to consider potential planning and implementation problems found in the niche; and reflect on different potential visions of PCI institutionalisation and pathways to their realisation. The failure of PCI to be taken up independently of the niche projects, scaled up or institutionalised within the Indian NARS is due to several reasons based on different socio-technical aspects of the niche and regime.

I will elaborate on these reasons, focusing specifically on how issues concerned with organisational structures, policies, legislation, accountability and organisational learning contribute to constrain the degree and type of engagement that an external project can achieve with a public research organisation. Some of these reasons will be contingent on the context of the case study, whereas others will be generalisable to other PCI projects working with public research sector organisations and/or as part of rural development projects. I will then revisit the approach that WIRFP and other niche projects have used to try to engage with the regime and highlight the differences between the limitations of the approach and problems of implementation that together contributed to the limited mainstreaming of PCI in the Indian NARS.

Next I reconsider the issue of institutionalisation looking at its multiple potential definitions, and outline weaker and stronger forms that a PCI project might seek to implement. In both cases I describe how they may be implemented, in the Indian context as well as potentially in

other NARS. Finally, I present an evaluation of the conceptual framework used for the thesis, before outlining a number of broad conclusions and wider implications for development practice.

7.2 PCI Contestation and Co-existence within the Indian NARS

7.2.1 Structural Hindrances

The Indian NARS features multiple state agricultural research and extension (R&E) systems and a centralised ICAR system which coordinates agricultural research across the individual states principally via AICRP. The semi-autonomous nature of the state R&E systems provides a unique challenge to PCI projects with respect to scaling-up and spreading PCI approaches since the relative autonomous nature of each state imposes geographical and separate institutional barriers. In order for other states to be exposed to PCI methods a potential PCI project would have to work closely with the agricultural research systems of those states. This poses a particular problem to projects such as the WIRFP that operated in a tribal region that spanned three state boundaries. In cases like this, three separate SAUs were involved, which required the signing of individual MOUs with each of these organisations. Engaging with multiple universities provided a degree of redundancy within the WIRFP project that potentially aided it when it was faced by bureaucratic and/or technical delays to the research programme involving a collaborative SAU. In these situations it might rely on the research progress made by one of the other SAUs. In principle working with multiple SAUs increased the opportunities available for promoting PCI methods which might also have lead to a greater number of sensitised staff and extra avenues for institutionalisation that would not have been present had they only worked with one university.

However, the management of multiple MOUs across different SAUs would likely have affected the capacity of crop programme staff at KRIBP/GVT to regularly meet and sensitise the concerned scientists to the potential benefits of the PCI methods in which they were collectively engaged. As presented in Chapter 5, the dedicated WIRFP crop programme staff were in need of further manpower support in order to meet their administrative duties, organise trial data, oversee trainings and meet with their farmer and scientist research partners. Moreover, the international consultants had busy schedules whenever they visited the project area, which imposed limits on the time they could spend with their SAU partners

and level of rapport they could generate. In light of these pressures, having to spend extra time at different SAUs may have reduced the capacity of the project to sensitise and influence SAU staff to PCI methods, and focusing on a smaller number of institutions may have yielded better results. Although particular to the experience of PCI in the WIRFP, the problems of engaging with multiple public sector organisations in a diffuse manner and the impact this may have on institutionalisation may be a generalisable lesson for future rural development PCI projects.

The WIRFP crop programme worked with the SAUs in Rajasthan, Gujarat and Madhya Pradesh because the project area consisted of an overlapping contiguous boarder region involving those states. As each SAU is tasked with agricultural research for a region within a state, it is understandable that a PCI project that is concerned with crop development for a particular locale will work with a local SAU that has its research station infrastructure within the same area. This poses a problem with respect to trying to scale-up and institutionalise PCI approaches at a national level since the centre exerts more influence on the state agricultural research systems through AICRP and other coordinating research institutes than the reverse. In a more general context, PCI projects seeking to institutionalise PCI methods should be aware of the policy and power dynamics between central and peripheral research organisations of a NARS, and how they can inhibit the spread of novel research methods.

At the SAU level there also exist structural hindrances to the wider adoption of PCI methods. In opting to collaborate with SAUs, the WIRFP project was required by the SAUs to formalise the research relationship through signing MOUs with each university and crop. However, the nature of the MOUs was such that although they involved senior plant breeders, the people who carried out the research and met with farmers were post-graduate level senior research fellows (SRF). The employment of a SRF meant that the senior level plant breeders could carry on with their other duties, and advise the SRF. It also meant that these senior breeders were not as closely involved in the projects as the SRFs, which may have limited their understanding of PCI's potential. Moreover, MOUs were signed between specific plant breeders and the WIRFP and did not involve all of the SAU's agricultural R&E scientists. This meant the PCI work at the SAU occurred within an external and ancillary research project that was 'firewalled' from the everyday research and extension activities, *co-existing* with, but not necessarily exerting much influence on them. In signing contracts to carry out collaborative research, future PCI projects should be aware of how the contract may only involve certain elements of

the R&E system, and how this can pose a barrier to implementing PCI methods and institutionalisation.

7.2.2 Regulatory and Policy Hurdles

During the first phase the KRIBP crops programme began working with SAUs because Witcombe argued that in order for the nascent PCI breeding programme to expand from the small plot of maize on the Dahod research farm to include other crops, more skilled personnel and land was required. Furthermore, in order for a beneficial novel plant variety to be adopted and diffused by any farmer, its seed needs to be maintained and multiplied. Since the crops programme was part of a wider development project, new project-level arrangements would have to be established in order to multiply and disseminate the new seed, and there was no guarantee that these would be sufficient or sustainable when the project finished. By working with SAUs, Witcombe hoped that their established seed multiplication mechanisms would maintain and multiply the PCI varieties once the project had finished, thereby allowing farmers to continue to benefit from the varieties.

The regulatory framework project, which was discussed in Section 5.2.3, presented an analysis of the varietal testing and release system for each of the three KRIBP (W) states and the national research system. The assessment also considered the role that PCI methods could have in refining these research systems. As explained in Chapter 5 (Box 5) this external review of ICAR's regulatory framework coincided with an internal review that favoured the retention of the existing system. Through presenting and promoting this review to ICAR, the project team promoted an assessment that was incongruent to ICAR's, which may indicate why the eventual *Seeds of Choice* book failed to be published and its lessons adopted by ICAR. This example highlights the problem with internally and externally originating policy discourses – the former in this case took precedence over the latter. The occurrence of the not-invented-here bias in this instance is understandable considering that ICAR would have carried out its own consultations on the efficacy of its testing system. The not-invented-here bias may also occur when an externally derived competing narrative or policy is presented to or imposed on a system that has formulated an alternative policy based on its own set of criteria. An example of this was observed when the current and previous Directors of the Directorate of Maize Research (DMR) questioned the rationale of using PCI to produce open-pollinated varieties, which they thought were inferior to the single-cross hybrid research, which they promoted for all types of farmers.

As discussed in Chapter 6, Section 6.4.2, the breeding agenda advocated by ICAR through the AICRP system and its directorates, such as the DMR, directly affected the breeding agenda set within SAUs. In this context the breeding agenda of the crop directorates becomes *de facto* policy strongly influencing each state's research trajectories. Since the collaboration forged between the SAUs and WIRFP did not directly involve any of the ICAR directorates, it was unable to effectively challenge this centrally-mandated form of research. Moreover, since each MOU only involved a subset of the plant breeders at any one SAU, not all of the researchers and extension staff at the university would have been persuaded of the potential merits of the PCI approach as a means of addressing tribal and rain-fed farming system problems. Those conflicting and co-existing narratives and policies and the limited direct exposure of staff would have meant that the merits of PCI would have been contested in important *fora* such as the ZREAC and more importantly the varietal release committees.

Contestation of the merits of PCI varieties by R&E staff at the level of the ZREAC and varietal release committees occurred during the WIRFP. One of the main reasons for this is that these committees have established standards for determining VCU and DUS criteria. The use of data collected by farmers from their fields and its inclusion by researchers and project staff on varietal release proposals would have raised the eyebrows of some of the more conventional plant breeders. Although the WIRFP suffered a few delays when it had to collect additional information to support some of their varietal release proposals, the project still managed successfully to negotiate the state varietal release pathways for several varieties. WIRFPs experiences negotiating varietal trial and release system may provide a cautionary tale for other PCI projects operating in similar or different institutional contexts. If a PCI project were to collaborate with a public sector research organisation it should account for delays in trying to release its material due to testing procedures that do not recognise farmer-derived yield assessments.

7.2.3 Accountability and Poorly Functioning Learning Mechanisms

One of the other major factors that contributed to the continued contestation of the merits of PCI methods and their neglect within SAUs and the ICAR system in the Indian NARS is that researchers and plant breeders can blame any perceived poor adoption of technology on a resource-limited extension system. The Department for Agricultural Cooperation's State of Indian Agriculture 2011-12 document supports this line when it considers the different

'challenges' and 'ways forward' for the various sectors that make up Indian agriculture (DAC, 2012). In its section on 'extension research' (DAC, 2012: 181) the weakness of the public extension system in India is acknowledged, but little attention was given to understanding farmer demand, particularly with respect to crop traits, with emphasis placed on improving the dissemination of information to farmers on novel research products (DAC, 2012: 189-190). The document acknowledged however that,

> "The organized sector (including both private and public sector companies) account for about 15 to 20 percent of the total seed distributed in the country. The unorganized sector comprising mainly of farm- saved seeds accounts for the remaining portion." (DAC, 2012: 51")

A resource-strapped extension system is only one possible explanation for why the majority of farmers save their seed and do not purchase modern varieties. Unfortunately it does not appear that the Indian NARS uses its extension system well for sourcing information on farmers' needs and relaying it to scientists and policy makers at the SAU and ICAR levels. If the extension system does engage with farmers it tends to limit itself to Technology Assessment and Refinement (TAR), but this is usually carried out after a variety has been officially released and consequentially unable to be altered if found wanting. Although information from TAR might inform future plant breeding agenda, it would be more efficient to assess demand earlier in the plant breeding process. The current state R&E system does however have a structure which can be altered to be more client-oriented, which will be discussed in more detail in Section 7.4.3.

The lack of accountability and effectual learning mechanisms linking the R&E systems within ICAR and state SAUs means that the NARS is blinkered and shielded from the potential possibility that the plant varieties that they produce are not beneficial to certain demographics of farmers. It also means that it is difficult for the NARS to prove that its novel varieties are not being taken up because of an awareness failure on the part of farmers. Future PCI projects might look beyond generating new varieties with farmers to also creating new, or improving existing R&E linkages. If a PCI project were to facilitate an increase in consultations between R&E staff and multiple types of farmers on varietal choice, this may provide an important tool for influencing breeding agenda and agricultural research policies, which might further highlight the usefulness of PCI methods.

7.3 Structural Issues and the PCI Niche

The account of the experiences of the WIRFP project presented in the preceding two chapters yields some interesting discussion points regarding its structure and its achievements that may be generalisable to issues other PCI projects might experience in trying to work with the Indian or other NARS. In this section I consider the ramifications of undertaking PCI within a development project, specifically with respect to sustaining the project's benefits, and consider the issue of path dependency in the methods and modes of collaboration between research organisation and PCI project.

7.3.1 PCI in a Development Project Context

With respect to other PCI projects the COB PCI niche is unique in that it was a group of projects that were supported by streams of funding, mostly from DFID, which lasted for over 15 years. During this time core projects such as the WIRFP, EIRFP and other projects in South Asia interacted with each other through consultants such as Prof. Witcombe and his colleagues at CAZS-NR. As a manager of the DFID Plant Science Research Programme, Witcombe was also able to direct funding to projects such as the Regulatory Framework Project and High Potential Production Systems (HPPS) PVS work which provided evidential support of the beneficial potential of PCI methods in different contexts.

Characterising these projects as a niche, or as a single entity, is useful when considering how they shared insights, borrowed resources from and interacted with each other. However, it can lend them a false sense of planned structure and permanence that they never really had. When KRIBP was in the planning stages Witcombe initially planned to carry out PVS, it was only later that the crops programme adopted and developed the PPB approach within the project. The WIRFP was a participatory development project first and foremost, which contained an *embedded* PCI element that became the central feature of its crops programme.

Being a constituent part of a larger development project imposed constraints on the way that PCI was carried out. Since the WIRFP was not only a PCI project, the crop consultants and their crop programme colleagues had to adapt the 'methodology' to fit the organisational and institutional structure of the larger project. This meant that PCI was carried out within a

predetermined project area spanning three states, and in preselected villages, rather than planning a project area that better suited the PCI crops programme. Moreover, the project had planned to work with the para-statal organisation KRIBHCO, rather than with the state agriculture and rural development departments. This allowed the project a measure of freedom to implement its then *avant-garde* participatory methods in a way that would be minimally affected by government bureaucracy. It also meant that when the WIRFP crops programme came to form collaborations with SAUs, it did not have any direct link with ICAR or other government organisations which might have presented a more supportive context for the scaling-up of PCI methods.

PCI arose out of participatory research critiques on technology development, such as *Farmer First*, and has consequentially been used in development projects, although its use is not confined to this context. When used as part of a rural development project the goals of PCI can be subsumed by those of the larger project. However, if PCI is used as a tool within the context of a larger rural development project then it can benefit from the project's infrastructure and reach in rural areas. Smaller PCI projects may involve or be run by NGOs with a smaller operational area. However, receiving development project funds may allow NGOs to increase their coverage and reach through employing new staff, creating an extended ephemeral network of staff that mimics an extension system; although the issue of project sustainability becomes important when the funds run out. If PCI is to feature as part of a larger development project, PCI practitioners should be aware of the *praxis* of the development project and how it may support or detract from its ability to collaborate with public agricultural research organisations.

7.3.2 Sustainability Issues for Projectised PCI formats

The nature of any interventionist development project is that it is usually dependent on a time-limited source of external funding. In order for the effects of a development project to persist after it has finished, the project must engage in a form of intervention that has a degree of physical permanence and/or create or enhance socio-cultural institutions to take on the role of the project that can grow or maintain themselves in the absence of project funding. These types of interventions have to occur within the time span of the project.

The success of a PCI project intervention can be constructed by its practitioners in relation to the varieties that are bred (PPB) or chosen by farmers (PVS). New varieties can confer single

factor productivity increases to agricultural yield as well as other benefits such as, disease and pest resistance, favourable organoleptic and market qualities, *inter alia*. In the case of self-pollinated crops such as rice, with training farmers can save the seed *and* maintain the genetic purity of the PCI varieties, preserving their benefits for future plantings[135]. In the case of open-pollinated varieties such as maize, genetic purity decreases year-on-year and after approximately three to four years the maize type will lose its advantage over local varieties (Morris et al., 1999a). Sustainability in the context of a PCI project depends firstly on the ability of farmers to maintain the varieties or source new seed for the varieties in the short-term, and secondly on their ability to receive appropriate and desirable varieties in the long-term. The first factor of sustainability requires the project to train farmers or set up self-sustainable seed multiplication groups, and the second requires the R&E system to breed and produce seed of varieties relevant to the needs of the group of farmers that the PCI project was working with[136].

The WIRFP attempted to interact both with the Indian and state agricultural research systems, but only managed to get one variety, GM-6, multiplied by the state seed corporation. Under the RIU programme GVT also experimented with creating seed producer companies, although their long-term viability remains to be seen. Setting-up institutions and cooperatives to sustain PCI approaches and making them independently and financially sustainable within a five-year project timeframe is also a challenging task. Future PCI projects need to investigate the most sustainable way of maintaining PCI varieties after the project has finished, prior to its inception, whether that is through partnering with farmer, public or private sector seed systems.

Due to the time-limited nature of projects and the length of time that it takes to breed and test new plant varieties, most PPB projects only last for one cycle of plant breeding and testing. If the concerned farmers are not currently being well served by the R&E system, institutionalising a more client-oriented form of plant breeding and extension that engages directly with them might serve them well in the future.

[135] Genetic purity is not necessarily a quality that CDR farmers desire since they may find more benefit in crop populations with higher intra-specific variation than growing one genotype. However, maintaining the genetic purity of seed will sustain the qualities of the seed that they originally purchased or received without losing them during subsequent selections and seed saving.

[136] Alternatively farmers can be taught plant breeding methods which they can use to improve their own landraces, however, the sustainability of this approach is not known.

Although a project may be time-bound, the interactions between project organisations and intermediaries such as NGOs and farmers are likely to persist if future rounds of funding can be generated. The Indian PCI niche, operating for over 15 years, exemplifies just how long these relationships can remain productive, although it is also somewhat of a unique case. By relying predominantly on a single source of funding from DFID, the PCI research network developed a relationship with the development agency that allowed it over time to continue its PCI interventions as well as develop evidence in support of its approach. However, as of November 2012 the UK government had halted its future aid commitments to India. PCI carried out within research or development project contexts will always face uncertainty when it comes to scaling-up and institutionalising the approach within research institutions because this process is often convoluted and requires the establishment of working relationships over a time period that may be longer than what the project has available.

7.3.3 Path Dependency and Planning for Institutionalisation

One of the key points to consider when evaluating the Indian PCI Niche's activities is that Witcombe and his project partners were one of the first pioneering groups using PCI methods. KRIBP was also an early adopter of participatory development methods within the context of a large scale development project. The structure of KRIBP and its crops programme was based on an initial in-depth literature review and rapid rural appraisals carried out by a project formulation team. On the basis of these initiatives the general structure of the project was created, as described in Chapter 4. The structure of the project and the roles of its stakeholders were set from the beginning of the project, and created a form of behavioural lock-in and path dependency that one expects when an organisation generates a fixed organisational structure. Although project structures, praxis, and stakeholder roles were not set in stone, there were limits to what could be altered in order to address the lessons arising out of implementing participatory methods.

As PCI came to feature centrally in the WIRFP crops programme and Witcombe pushed for greater collaboration with the Indian NARS, the institutionalisation of PCI was limited by elements of the project that it had co-evolved with, such as project implementation delays, CO roles, etc.. Although attempts were made by niche actors to better understand the regulatory frameworks of the Indian NARS and numerous efforts were made to sensitise plant breeders to the merits of PCI, collaboration between the crops programme and SAUs via MOUs did not allow for a more complete embedding of the method within the Indian NARS. Future PCI

projects that seek to collaborate with public plant breeding systems might benefit from the lessons learnt from the WIRFP with respect to institutionalisation as presented in the following section.

7.4 Pathways to PCI Institutionalisation

The preceding chapters have presented a characterisation of some of the major socio-technical elements of the Indian NARS and the WIRFP, and chronicled how the PCI crop programme collaborated with the Indian NARS at the state level. Through considering their respective structures and manner of interactions, the following insights have emerged with respect to institutionalising PCI methods that may be generalisable to other PCI projects undertaking collaborative research with the Indian or other NARS.

7.4.1 Institutionalisation: Multiple Definitions

In the same way that 'participation' can be considered a polysemic word with divergent interpretations, so to can 'institutionalisation' depending on the context that it is used in. This thesis has focused on a case-study of PCI that was implemented in the context of a development project. Consequently it was influenced by the objectives of the development project with respect to targeting tribal farming families with its interventions while also trying to sustain the benefits of these interventions after the project had finished. With respect to PCI within the crop programme, sustaining benefits implied that farmers retained access to the seed of their favoured varieties or that their varietal preferences would be considered and included within future breeding programmes after the project has finished.

The literature review demonstrated that there are multiple ways in which PCI can be implemented. PPB is a research method and PVS can be used for both research and/or extension, but collectively in the context of their use in a public R&E system, they can be thought of as improving the client-orientation of the research system. Throughout the WIRFP the nomenclature and ways in which the PCI methods were used changed over time. Initially the methods were referred to as Farmer Participatory Research (FAMPAR) trials, later they then became known as PCI, PPB and PVS, before finally being termed Highly Client-Oriented Breeding (COB). The eventual use of the term COB reflects the experiences of the PCI niche's engagement with public R&E systems. With the concept of 'client-orientation' the question

with respect to scaling-up and institutionalisation of PCI methods moves away from, “How can the methods become more farmer participatory?” To, “How can the R&E system become more client-oriented?” In this respect the involvement of farmers in R&E is about producing appropriate technology for them as an ‘end’, rather than their mandatory participation as a ‘means’. Farmer involvement at different stages in the R&E process reflects the best way for the R&E system to target and test their new plant varieties with farmers.

The degree of client-orientation that an R&E system can achieve depends on a number of factors involving the R&E system’s ability to:

- Identify and subsequently target the requirements of different types of farmers and their GxExM conditions, and;
- Test the products it produces under the farm management conditions of these different types of farmers more accurately to gauge the target environment and constraints farmers face in implementing technologies.

High client-orientation of a research system depends directly on its ability to develop strong R&E linkages that link farmers to researchers and *vice versa*. Moreover, the ability of an R&E system to become more client-oriented is constrained by its current infrastructure and praxis. Institutionalisation of PCI in this respect might consist of a hybrid form of PCI that fits the structure and form of the research system. However, this form of institutionalisation is still constrained by the resource-limited extension system which may make it difficult to target more isolated groups of farmers.

Another form of scaling-up and institutionalisation of PCI could result from plant breeders generating project proposals that involve public-private partnerships between NGOs and R&E organisations. This is similar to the MOU relationship between WIRFP and the SAUs, however rather than relying solely on development agency funding; SAUs might also generate project proposals which utilise GoI agricultural scheme funds to target specific areas with a high mean varietal age[137]. By working collaboratively with an NGO, an ephemeral extension system could be supported that targets these areas, operating alongside conventional research. This is necessarily contingent on the research organisation valuing PCI methods, having the

[137] A high mean varietal age for an area suggests that the varieties grown there are old. This region would be a good target for targeted plant breeding and extension initiatives as farmers would not have adopted more modern varieties.

manpower to spare for the project, and working with an NGO that has the capacity to carry out PCI activities.

Weak forms of institutionalisation can be thought of as creating a more favourable environment that is permissive of PCI and working with NGOs using public funds. There is some evidence of this within the Policy Framework for Agricultural Extension (2000) that allows for the use of public funds to finance extension PPPs to be formed between the public sector organisations and NGOs (*Cf.* Promotion of Farmer Participatory Technology 3.3.1.4, Public funds for private extension services 3.3.1.9). It is likely that the WIRFP and other participatory projects in India went some way to influencing these extension system changes. However, a more demand-led extension system does not necessarily translate to a more demand-led research system.

Rather than the universal adoption of PCI methods within public sectors research organisations, stronger forms of institutionalisation might refer to a PCI project altering an R&E organisation to make its research praxis more client-oriented through adapting its current infrastructure. This approach is discussed in more depth below.

7.4.2 Is Institutionalisation of PCI Universally Desirous?

From the perspective of a development project carrying out PCI, if the project manages to institutionalise some form of PCI methods within a public R&E organisation then it may be able to construct a claim to the sustainability of the impacts and benefits of its intervention. This is a desirable situation for a development project as it strengthens the claims of success that it might make with respect to its crop and livelihood interventions. This can act in the favour of the involved staff or research network when they bid with future research proposals.

PCI projects can involve a variety of partners acting as intermediaries or implementing agencies such as NGOs and CBOs. In learning about, and training staff in, PCI methods these organisations equip themselves with an extra methodological tool, which they can use in future collaborative projects or by themselves. After learning about PCI they may also propose PCI projects of their own. A weak institutionalisation of PCI, which makes FPR more permissible in public R&E contexts will reduce the barriers these organisations face in trying to perform collaborative PCI projects. However, a more permissible environment does not

necessarily mean that more PCI projects of this sort will occur. It largely depends on the perspectives of key stakeholders or R&E gatekeepers within the R&E system.

The public R&E system may opt to work more with NGOs to take advantage of their organisational reach into rural hinterlands where the state agricultural extension system does not function, or it may aim to reform its current institutions to make them more oriented to those clients, but whether it does engage in these forms of PCI project or internalise these critiques depends on whether it views them as desirable and feasible with respect to its current research agenda. 'Desirability' is a function of whether R&E staff recognise the appropriate technology critique of PCI *and* find PCI methods a useful way of addressing it; whereas 'feasibility' is related to whether PCI methods can be adopted within the current research budgets, infrastructure and manpower constraints of public sector R&E organisations. It is beyond the remit of this thesis to comment on research budgets other than to say that, although research funds are disbursed by the Indian government mainly in the form of block grants to ICAR and SAUs, competitive funds are becoming more common and present some potential to be used for adaptive, PCI research, although these funds are highly sought after (*Cf.* Pal and Byerlee (2006: 164-175) for more details).

7.4.3 Opportunities for Knowledge Translations Between Niche and Regime

For a PCI project to Improve the 'desirability' of the PCI narrative within public plant breeding R&E systems, it needs to adopt a targeted approach that specifically highlights deficiencies in current R&E practices, while also demonstrating the capacity for a form of PCI to usefully address this problem. Research evidence that shows the utility of PCI methods in addressing the needs of a specific client group of farmers in a development project will not necessarily translate to the context of a public sector R&E system if it focuses on different clients. To further enhance the chances of an R&E system adopting a form of PCI, a PCI project should make efforts to collaborate with its partner organisation within the R&E system in order to determine how well the current research system is functioning with respect to client identification, orientation and the adoption and spread of the organisation's varieties. If the project were to instigate a case study that investigated the performance of the crop varieties that a research organisation had produced over a period of time, against the requirements of farmers across the case study area, this would provide the organisation with evidence of whether a greater degree of client-orientation was needed with respect to their research agenda. This type of case study could use PRA methods to elicit farmer preferred crop traits

and better understand their lack of adoption of current technologies. This would as a minimum provide the research organisation with a better understanding of the technology requirements of different farmers in that area, while also potentially presenting a stronger case for PCI.

Feasibility and cost-effectiveness of PCI is one of the major barriers to its adoption within the Indian NARS. In many cases organisations within the Indian NARS face manpower and financial constraints (Sulaiman V and Hall, 2002, Pal and Byerlee, 2006). A PCI project might find use within an R&E system if research organisations or NGOs can successfully apply to agricultural competitive funds to finance the project. The formation of public-private partnerships to carry out PCI can allow for a temporary expansion of the public sector's extension system into more isolated rural areas where it does not currently have sufficient reach. However, in order for this relationship to work one of the partners must have the necessary rural infrastructure and trained staff in order to interact collaboratively with farmers.

Alternatively, the public-sector could adapt its existing infrastructure and R&E processes to make the R&E system more client-oriented than it is presently. At the state level in India there are already organisations and institutions in place that could implement or improve accountability mechanisms between the research system and all farmers. Current SAU-level committees such as research department meetings and the ZREACs could be better utilised to help formulate plant breeder research agendas. A more structured and less *ad hoc* form of research agenda setting depends on the information made available to plant breeders regarding the needs of farmers. Although the Indian Policy Framework for Agricultural Extension (2000) prescribes the need for better demand-led technology dissemination, this is not sufficient. The extension system should make better provisions to determine different farmer requirements and channel these to researchers in a structured manner. There are two types of extension institution in India that could be engaged to provide this information: the ATMA and KVK systems. The ATMA system operates at the district level and requires that Strategic Research and Extension Plans (SREPs) are created for each district. The inclusion of the word 'research' in the SREP is misleading since it is still fundamentally a system for the transfer of technology. Instead SREPs tend to use PRAs to elicit information on the farming systems and extension needs of farmers within a district. If ATMA and extension staff were to receive better training in implementing PRAs more types of farmers might be involved more actively in the process and not solely as passive participants in an information gathering exercise (*Cf*. MANAGE (2005: 18-19).

Similarly KVKs operating at the district level can be used to strengthen farmer-researcher linkages. Currently KVKs adopt a technology transfer approach to extension, although they are also involved in the activities of Technology Assessment and Refinement (TAR), Front-Line Demonstrations (FLDs) and On-farm Trials (OFTs) of finished crop technologies. OFTs are used to test finished varieties on farms whereas FLDs are used to demonstrate varieties to farmers. In both cases staff test varieties using the recommended package of practices as opposed to the management practices of the farmer in question. OFTs and FLDs could be adapted to a PVS format where farmers have the opportunities to evaluate the varieties under their own management practices. KVKs use TAR to test finished varieties; however, it is mainly used in the context of refining the recommended package of practices to their clients. TAR provides plant breeders with an *ex-post* assessment of varietal performance in a particular region however, since it is carried out after varieties have been released, only the management practices associated with the variety can be altered to change its performance. Moderation of existing OFT, FLD and TAR practices could represent a pathway for carrying out a more client-oriented form of research without requiring much new funding.

PCI development projects should consider the following issues when engaging with public R&E systems. If a PCI project works on multiple crops and aims to institutionalise a client-oriented PCI approach it can pose problems with respect to the number of different organisations that the project has to engage with. For example, WIRFP worked with multiple SAU partners on multiple crops. This is something that can act to dilute the efforts of project staff to institutionalise the approach. Recently Witcombe was paid by Sher-e-Kashmir Agricultural University of Agricultural Science and Technology (SKUAST), Srinagar, to consult with them on COB[138]. The initiative was led by the Vice Chancellor of the SAU and involved both the Directors of Research and Extension and their staff. It is too soon to tell how the university will reform its research programme to be more client-oriented, but their willingness to reform may largely be due to the involvement of the Vice Chancellor and the participation of *both* the research and extension side of the university. The involvement of the heads of the research and extension side of the university could allow for the fostering of improved R&E linkages. This approach differs from signing an MOU and it will be interesting to see what happens at the SAU in the future and whether it is generalisable to other PCI projects.

[138] John Witcombe Interview, Bangor, 9th October 2012

In trying to scale-up PCI methods, projects which use PCI should be aware that there are a variety of activities that could be taken up alongside PCI in order to create an organisational context within R&E organisations that is more amenable to PCI and client-orientation. At the community level farmers can be sensitised by project staff as to the functioning of the R&E system in order that they can engage better with the extension system and articulate demands for technologies that they require. The outcome of the WIRFP suggests that carrying out MOUs and a PCI project is not enough to inspire staff to adopt the approach after the project finishes. If a PCI project can also demonstrate that there is a demand for its methods and for agricultural technologies that a research organisation is not currently producing, then the research organisation may be more amenable to engaging with farmers more collaboratively.

7.5 Evaluating the Conceptual Framework

The conceptual framework was designed to address the general research question stated at the beginning of this chapter. The question arose out of considering PCI methods, their supposed logically congruent underpinnings, and why, in spite of much experimentation and development, they have remained marginalised and contested in agricultural research sectors around the world. Shawn McGuire's article on 'Path Dependency in Plant Breeding' highlighted the importance of "opening the 'black box' of a programme", in order to understand how, "norms in theories, institutions and policies help make specific practices 'valid' within a breeding programme, and how such norms, combined with the costs of learning about or developing new practices, can inhibit change" (2008:12). This thesis has gone some way to addressing these concerns, and in this section I will discuss how the conceptual framework has contributed and may be of use in other development project contexts.

Initially I found the ideas of 'niche' and 'regime' particularly useful concepts, since through their consideration, they established two important units of analysis for considering the broad idea of institutionalisation. However, in and of itself, SNM, as it is often presented in the academic literature, is not best suited to dealing with development projects in developing countries (*Cf.* Section 3.2.2). The work of Romijn and colleagues (2010) paved the way for me to develop a synthesis conceptual framework using learning based-development approaches (LBDA) and SNM concepts. I have found that there are complementarities that can be found in using SNM and LBDA concepts together. Broadly speaking, SNM can be made more

appropriate to development contexts and projects, whereas conventional learning-based approaches can be expanded in scope to consider broader institutions outside the immediacy of intra-project dynamics. In adding 'boundary management' as a third unit of analysis, I feel that this modified framework provided three useful domains: niche, regime, and their interactions, which I could analyse using my list of modified socio-technical dimensions.

I found that modifying the definitions of what constituted the socio-technical dimensions of niche and regime would allow me to incorporate concepts from LBDA that I could use as optics to analyse the structure and dynamics of each of the three units of analysis. I started with a series of socio-technical dimensions from an article by Geels and Schot (2008:546), which they listed as science, culture, technology, policy, industry, markets and user preferences. My modified list, consisting of core narratives, scientific praxis, organisational structure, user relations & accountability, policy & regulations, and knowledge management, allowed me to refine and expand the original socio-technical dimensions to incorporate issues more relevant to the context of the thesis. In particular, these modified socio-technical probes allowed me to consider issues of power, political, and temporal-spatial dimensions not explicitly dealt with in SNM (*Cf.* Lawhon and Murphy (2012)). I found the socio-technical probes that I chose were useful in characterising both the structures of niche and regime and the processes that occurred within and between them. I do not think that the probes that I used are necessarily a definitive set of socio-technical dimensions that should be used in all development project contexts. However, they have proved a useful toolkit for considering the operation and structure of different institutions working together.

I found Haywood's (2000) approach of considering power, as a social boundary that constrains and enables action for all actors, a useful concept within the context of the third unit of analysis, 'boundary management' (*Cf.* Section 3.2.4). I also found that in the process of operationalising the conceptual framework, defining the boundaries of a case study necessitated considering the geographical location of niche and regime and the time period to be considered. Lawhon and Murphy's (2012) critique of SNM, that it does not explicitly consider issues of time and place, or rather that SNM accounts tend to be limited to the national level, is not relevant to how this framework was implemented. Although the focus of this thesis was on a specific Indian PCI niche, key events were highlighted in what might be considered the global PCI niche and the influence that they had on actors and relationships within the Indian PCI niche.

There are a number of lessons that can be learned from trying to implement a SNM framework in an agricultural development project context in order to investigate an historical attempt at institutional change. Firstly, in trying to adapt SNM to the context of agricultural development projects, which aspects of the theory are extraneous and which lead to useful insights? The MLP model states that the regime may be destabilised by pressure exerted from landscape effects that the niche can then take advantage of. Landscape pressures are poorly defined in the literature and may often remain ambiguous as it is difficult to trace their effects to particular destabilisations of a regime. I think that they are of limited use for *ex-post* analyses of agricultural development projects, and almost impossible to use in the planning, monitoring and evaluation of current projects. Moreover, the broad concept of socio-technical transition pathways, with the evolution of the status of technological niches to that of market niches, may not translate to agricultural development projects and how they are funded. The terms 'niche' and 'regime', and the idea of power struggles that may occur between them, are interesting concepts for people trying to understand how the institutionalisation of technologies, practices and approaches implemented in development projects fail to get mainstreamed within other organisations and partners. However, many development projects can only tenuously be labelled as a niche since they seldom work together, persist over a prolonged period of time, or even work with the same institutions and partners.

Secondly, the aspects of SNM theory that do not accord with the experiences of agricultural development projects trying to institutionalise technologies and practices within partner organisations, such as traditional definitions of technological and market niches, can still provide insights into how development projects struggle to be successful in institutionalising their findings. One of the key underpinnings of socio-technical transitions theory is the development of a technological niche into a market niche, providing the niche with a more stable and sustainable configuration for it to interact with the regime. The general structure of development projects, whom they are accountable to, and their transience, typically differs from this pathway and may conspire to limit a project's ability to institutionalise aspects of its praxis into the regime. This is discussed in further detail in Section 7.6.

Finally, although the conceptual framework has been used to construct and investigate an ex-post history of niche development and regime engagement, the following insights may be of use in the planning, monitoring and evaluation of current agricultural development projects. If some form of institutionalisation is a project goal then it may be important to plan around the three units of analysis used within this thesis: the project, partner organisations, and the

boundaries between them. Planning for institutionalisation requires an understanding of how the different socio-technical dimensions mentioned above interact to define the structures and functions of the different organisations. An informed understanding of differing organisational structures, praxes and the narratives that underpin them can help development professionals to better communicate, mediate and translate knowledge across organisational boundaries in ways that address the concerns of their project partners. An enhanced understanding between partners on multiple levels can only serve to improve the chances that lessons, methods and technologies are shared and adopted. Regular Monitoring & Evaluation (M&E) is also essential in order to make sure that projects can adapt and not suffer from path dependency or lock-in that can reduce their chances of institutionalisation. This is particularly a risk for those projects that are involved in actively creating or developing technologies since their eventual uptake is dependent on the needs of both end users and partners. These suggestions outline just some of the ways in which a hybrid SNM framework can be used within a development project. In the next and final section, I will discuss some of the wider implications of the findings of this thesis to development practice in general.

7.6 Wider Implications: Generic Conclusions for Development Practice

There are several research findings that have wider implications for the ways in which development projects and programmes are carried out in general. Although groups within a research system can be commissioned to carry out specific agricultural research, this thesis considered an example where agricultural research was an embedded component of a rural livelihoods-oriented development project. As such, the agricultural research component found itself incorporated within a broader project structure that both enabled certain activities while constraining others. In order for a development project to increase its chances of successfully implementing its goals, it should be sympathetic and receptive to the changing needs of its various components. This is important in cases where exploratory research and technology development are being implemented, in which case, inflexible project management processes could lead to path dependency, lock-in and inappropriate technology development. The presence of rigid structures, boundaries and hierarchies within projects can also make it difficult for them to successfully implement participatory methodologies and act on the information generated by them in *collegial* rather than in *consultative* or *exploitative* ways. In projects with rigid internal structures that resist alteration from institutional learning

processes, the knowledge generated through participatory methods might not be able to change the focus of projects beyond preconceived domains of action. This can negate the purpose of participatory research through maintaining a top-down project hegemony in which bottom-up participation remains tokenistic. Effective institutional learning and knowledge management processes are critical to the success of both agricultural and participatory research.

Development projects differ from strategic and market niches in that the former are largely accountable to donors whereas the latter to the market or end users. In order for them to be successful and sustainable, the innovative niche needs to undertake market research in order to produce appropriate and desirable products for its target end users. In this way the niche might generate a useful and valuable product and the profits derived from its sale can be fed back into the niche in order to further develop both it and the niche. However, the innovative products and processes of development projects face significant risk of being unsustainable. Agricultural development research is often linked to market failures – technologies and practices are developed for farming demographics whom may not have the funds to engage in the market, or the technologies and processes themselves are not profitable. In these cases institutionalisation is important to sustain the output and benefits of the project, however, donor funds are finite and the length of a typical development project cycle may not be enough to engage in institutionalisation activities, particularly if they are appended on to the end of the project. If some form of institutionalisation is an important objective for a development project, donors and project planners need to be realistic with the timescales needed for institutionalisation. A longer running development programme consisting of several projects, mimicking a niche, may be needed to adequately address the issue of institutionalisation. This may help projects adapt and apply lessons learnt throughout one project cycle in a subsequent one, and may be particularly useful if the project is involved in novel research and technology development, when initially niche/regime structures and dynamics may be indeterminate.

In funding research and international development projects, donors can impose accountability requirements and evaluation frameworks that generate unforeseen effects. Evaluation frameworks can skew the types of output sought by a project, i.e. poverty rather than sustainability indices, and this can in turn impact on the types of project objectives, processes, structures and reporting that are generated. Although project accountability is important, donors should demand adaptable and robust project planning, monitoring and evaluation

processes, rather than impose a rigid system that might not be appropriate to the complex and changing realities of the project in question.

In drawing this discussion to a close, I end on what I think is one of the most interesting and important insights derived from this thesis, and one which is of great relevance to the design of future development policy and practice. The issues surrounding the institutionalisation of the knowledge and technological outputs from development projects are complex, and often essential to whether they are sustained over time. While a poverty and livelihoods-oriented approach to rural and international development is important, the commissioning and targeting of appropriate pro-poor research is essential to address market failures within conventional private and public sector R&D systems. In spite of the significance of institutionalisation to research and international development projects, it seems that much of development practice focuses on the project and not the wider institutional context that it is embedded in and with which it interacts. This myopia may be due to the way in which projects are commissioned and funded by donors, including the reporting procedures they impose on project practitioners.

However, I believe that there is great scope for engaging social scientists in institutional analysis and boundary management roles to better understand the barriers and opportunities for institutionalisation and to mediate knowledge transfer and interaction between disparate partners. Social scientists, working in a multidisciplinary team or hired as consultants, can work alongside other project staff throughout the project, at particular stages, or where appropriate in parallel projects as part of a larger programme. Furthermore, social scientists engaged in this manner would be well positioned to engage in novel collaborative counter-narrative studies of the type discussed in Section 7.4.3. Collaborative counter-narrative studies that generate understanding between partners and target areas of ambiguity and uncertainty, in conjunction with shared planning and M&E sessions between partners, may together foster potential pathways to make innovations relevant to all parties concerned. This can only enhance the potential for an innovation to be incorporated and institutionalised.

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9 Appendices

9.1 Appendix 1: Reports Collected During Fieldwork

#	Title	Date	Organisation
1	Seeing is Believing… encouraging adoption through FLDs on Rice. A Comprehensive Report on Frontline Demonstrations (1990-2005)	2007	DRR
2	A brief Report on Frontline Demonstrations on Rice (2006-07)	2007	DRR
3	Frontline Demonstrations on Rice (2007-2008)	2008	DRR
4	Frontline Demonstrations on Rice (2008-2009)	2009	DRR
5	Frontline Demonstrations on Rice (2009-2010)	2010	DRR
6	Cultivation package for DRRH-2 Hybrid	-	DRR
7	Cultivation package for Rice Hybrids	-	DRR
8	Maize Hybrid and Composite Varieties Released in India	2011	DMR
9	Single Cross Hybrid Seed Production Technology in Maize	2011	DMR
10	All India Coordinated Research Project on Soybean. Director's Report and Summary Tables of Experiments (2010-2011)	2011	DSR
11	Training Manual for Strategic Research and Extension Plan (SREP) SREP Core Team Training (02-06 Jan. 2006)	2006	ATMA
12	SRR of different crops in MP (%)	2011	RVSKVV
13	Seed Management (Yasin *et* al., 2006)	2006	RVSKVV
14	Directorate of Research Services - Breeder Seed Production Programme, Kharif - 2010 BSP-I [Field Crops]	2010	RVSKVV
15	Directorate of Farms - Rabi Production 2008-09 BSP – IV	2009	RVSKVV
16	Quantity of Breeder Seed Actually produced BSP-IV Kharif 2009	2009	RVSKVV
17	Directorate of Research Services - Breeder Seed Actually Produced BSP-IV	2010	RVSKVV
18	Crop improvement: Status and Strategies	2009	RVSKVV
19	Minutes of the ZREAC Kharif 2010 Meeting Held on 10-11 March 2011	2011	MPUAT
20	Livelihood and Nutritional Security of Tribal Dominated Areas through Integrated Farming System and Tecnology Models. Highlights 2007-11	2011	MPUAT
21	Research at MPUAT – A Decade (2000-2009)	2010	MPUAT
22	Krishi Vigyan Kendra, Banswara. Annual Progress Report (April 09 to March 2010)	2010	KVK (Bans.)
23	Conservation and Sustainable Use of Cultivated and Wild Tropical Fruit Diversity: Promoting Sustainable Livelihoods, Food Security and Ecosystem Services	-	Bioversity
24	MAIZE (Zea Maize) Memorandum of Understanding	2000?	GVT
25	CHICKPEA (Cicer arietinum L.) Memorandum of Understanding	2000?	GVT
26	Making Sense of the Evidence from 14 years of innovations in rural livelihoods	2007	GVT
27	Together We Win	2006	RVSKVV/GVT
28	Cultivating Partnerships - Better Choices for Rain-fed Farming	2006	GVT/CAZS-NR
29	Producers' Companies	-	DPIP
30	National Rural Livelihoods Mission - Framework for Implementation	2010	GoI
31	Farmer-Proofing Agricultural Research - Current trends in India	2008	DDS
32	RAITA TEERPU [Farmers' Verdict]	2009	DDS
33	Seeds of Choice (Book)	1998	PSP

9.2 Appendix 2: Extended Plant Breeder Interview Schedule

Varietal Testing and Release

1) What are the different testing and release pathways?
2) Have there been any changes to the way that varieties are tested and released in MP over the last 15 years?
3) Does on-farm testing and popularization occur during varietal testing or after varietal release?
    a) Who is responsible for OFTs and popularization?
    b) What information is recorded and passed back to farmers?
    c) Are multiple varieties popularized at the same time (FLDs vs. PVS)?
4) During plant breeding is there a vision of who the varieties are being bred for?
    a) Are they selected and tested for under farmer management (input) conditions?
    b) How representative are the research stations of all the different agro-ecologies in the state?
5) What is the length of time of cultivar development → testing → release → popularization → and commercial growing?

Agenda Setting and Needs Based Agriculture

6) What is meant by needs based agriculture?
7) How are goal setting and breeding targets defined?
    a) What are the meetings / frequency / persons / organizations involved?
    b) Under what directives/initiatives are these meetings part of?
    c) Are problems derived from plant breeder – farmer interactions recorded and presented formally to create new breeding objectives?
8) What information is available to plant breeders to see how well their varieties are performing?
    a) Proportion of recent varieties grown in farmers' fields? / the weighted average age of varieties grown by farmers / seed indents?
    b) Does this information feedback to making new varieties?

Challenges in Plant Breeding (individual)

9) What would you say are the challenges/problems with plant breeding at the state level?
    a. *Problem definition* – what is the stakeholder's personal definition of problems and opportunities concerning plant breeding and agricultural research (state/central/public and private)
    b. *Awareness of other narratives* - perceived prevalence of different narratives and relative importance with respect to personal view.
    c. *What would constitute a good agricultural R&D policy and associated institutional support*

d. *Explanation of the organizational apparatus of policy promulgation* – who are the gate keepers, how can policy be changed and how has this happened in the past. Have there been external non-agricultural outside influences?

[USE Force Field Analysis → Diagram → Rank options →Determine main/end cause]

10) Repeat for national level

Farmer Participation

11) Are you familiar with farmer participatory research? (PVS/PPB)
    a) What do you understand by these terms?
    b) Compare with standard definitions.
12) What is the relative usefulness of PCI at the SAU level?
13) What are the organizational and institutional barriers to using PCI at the SAU level and in wider contexts (public/private)?

Interview Probes

- *Define normative plant breeding* – how do plant breeders carry out their projects and how does this relate to PCI approaches? What barriers are there for plant breeders wishing to pursue their own research trajectories? What is the goal of plant breeding in the state?
- *Define the socio-technical processes that make up the SAU plant breeding regime*.
- *Define the gatekeepers* - key stakeholders and structures which direct plant breeding research trajectories and have the power to institutionalize scale-up PCI.
- *Accountability/incentive structure* – what are the professional goals of being a plant breeder? Who are they accountable to? What kinds of research output do they need to produce?
- *Organizational learning and knowledge management* – To what degree are they practiced and how do they impact on future research trajectories?
- *Agricultural education* – is there is a link between research/extension and education activities? How do plant breeders publicise their work and stay up-to-date with the activities of other breeders (professional societies/journals/conferences/more informal methods)?
- *Politics and funding of research* – how do these relate to the types of research that plant breeders carry out?

9.3 Appendix 3: Formal Fieldwork Interviews

Date	Organisation	Interviewee	Role	Recording
13/05/2010	Directorate of Rice Research (DRR)	Dr. Mangal Sain	Principle Scientist and Head	Yes
13/05/2010	Directorate of Rice Research (DRR)	Dr. R. M. Sundaram	Senior Scientist (Biotechnology)	Yes
		Dr. A. S. Hari Prasad	Senior Scientist (Hybrid Rice)	Yes
14/05/2010	Deccan Development Society (DDS)	Mr. Vatturi Srinivas	Manager	Yes
14/05/2010	ICRISAT	Dr. Pooran M. Gaur	Chickpea Breeder	Yes
----------	Madhya Pradesh -Rural Livelihoods Programme (MP-RLP)	Mr. Duncan King	Team Leader	Yes
----------	Madhya Pradesh -Rural Livelihoods Programme (MP-RLP)	Mr. Shazad Khan	Technical Advisor	Yes
----------	Action for Social Advancement (ASA)	Mr. Yogesh Dwivedi	Theme Manager - Agri-Business	Yes
21/05/2010	Previous Plant Breeder from JNKVV, Jabalpur	Mr. Diness Sherma	Plant Breeder	Yes
21/05/2010	Previous Plant Breeder from JNKVV, Jabalpur (Cont.)	Dr. Yadavendra	GVT Crop Consultant	Yes
22/05/2010	GVT Field Office (Jhabua)	Focus Group	GVT Staff	Yes
----------	Anand Agricultural University (AAU)	Dr. Atul Mehta,	Research Scientist (Rice) (Head)	Yes
		Dr. S. M. Khanorkar	Senior Maize Breeder (Head)	Yes
03/03/2011	Indore RVSKVV	Prof P.D. Gaikwad	Head, G&PB	No
		Prof M. Billore	Prof G&PB	
		Dr I. Swarup	Senior Scientist (G&PB)	
		Dr V.P. Kataria	Scientist (G&PB)	
05/03/2011	GVT	Dr J.P. Yadavendra	Plant breeder consultant	No
06/03/2011	KVK	Dr Mahander Singh	Scientist (Agronomy)	Yes
		Dr R.K. Yadav	Scientist (Plant Pathology)	
08/03/2011	GVT	Mr Arun Joshi	Head, NRLI	Yes
08/03/2011	ASA	Mr Yogesh Dwivedi	Theme Manager - Agri business Promotion	Yes
16/03/2011	GVT	Mr Arun Joshi	Head, NRLI	Yes
17/03/2011	Indore RVSKVV	Prof M. Billore Dr I. Swarup	Prof G&PB Senior Scientist (G&PB)	No
18/03/2011	ASA	Mr Yogesh Dwivedi	Theme Manager – Agri-business Promotion	Yes
		Mr Ashish Mondal	Founding Director	
18/03/2011	DPIP	Mr Raman Wadhwa	Livelihoods & Procurement Coordinator	No
		Mr Nanyan Ranjan	Environmental Coordinator	Yes
		???	NRLM	Yes
21/03/2011	MPRLP	Mr Shazad Khan	Technical Advisor, TCPSU	No
		Mr Duncan King	Senior Manager/Team Leader, TCPSU	Yes

Date	Organisation	Interviewee	Role	Recording
21/03/2011	DPIP	Rajesh Tripathi	Agriculture Coordinator, DPIP	Yes
		Mr Arun Joshi	Head, NRLI	Yes
24/03/2011	GVT	Mr. H. K. Tomar	Head of Field Office	No
24/03/2011	KVK	Dr. Soni		Yes
24/03/2011	ZARS	Dr. D. P. Saini	Assoc. Prof. & Project Incharge AICCIP	Yes
29/03/2011	MPUAT		Director Plant Breeding	No
29/03/2011	MPUAT	Dr. Indrajit Mothur	Associate Director Extension	No
04/04/2011	DoA Office	Sudhir Verma	Assistant Director of Agriculture Extension	Yes
07/04/2011	MPUAT	Dr. Withal Sharma	Assoc. Prof. PB&G (Retd.) (Sorghum)	No
16/04/2011	Agriculture Today Magazine	Mr. Tafeem Siddiqui	Deputy Editor	Yes
20/04/2011	RVSKVV	Dr. H. S. Yadava	Director Research Services	No
20/04/2011	RVSKVV	Dr. A. K. Singh	Head PB&G (Prof.)	Yes
20/04/2011	RVSKVV	Dr. A. K. Sharma	Assoc. Prof. PB&G	Yes
21/04/2011	RVSKVV	Prof. V. S. Tomar	Vice Chancellor	No
21/04/2011	RVSKVV	Dr. Y. M. Kool	Director Extension Services	Yes
22/04/2011	DoA Office	Dr. M. R. Jatap	Joint Director Agriculture	Yes
23/04/2011	DoA Office	Dr. R. K. Dikshit	Deputy Director Agriculture	Yes
26/04/2011	Krishi Bhavan (Gujarat)	Dr. A. M. Parakhia	Director Extension Education	No
26/04/2011	Krishi Bhavan (Gujarat)	Dr. B. B. Kumdaria	Deputy Director Seeds	Yes
27/04/2011	AAU	Dr. Khataria	Director of Research	Yes
		Dr. A. M. Mehta	Research Scientist (Rice) & Unit Head	Yes
28/04/2011	AAU	Dr. S. M. Khanorkar	Sr. Maize Breeder, In Charge & Head	Yes
30/04/2011	GVT	Dr. J. P. Yadavendra	Crop Consultant	Yes
04/05/2011	DSR	Dr. S.K. Srivastava	Director; (Plant Pathology)	No
		Dr. D. K. Agawal	Scientist; Plant Breeder	
		Dr. V. S. Bhatia	Principal Scientist; Crop Physiology	
		Dr. B. U. Dupare	Senior Scientist; Agricultural Extension	
		Dr. G. K. Gupta	Principle Scientist; Plant Pathology	
10/05/2011	Bioversity	Dr. B. Sthapit	Former Colleague of Witcombe	Yes
11/05/2011	GVT (UNDP SGP)	Mr. Sodhi	Former Head of WIRFP	Yes
16/05/2011	Gene Campaign	Dr. S. S. Sahai	Consultant / NGO director	Yes
16/05/2011	Navdanya [FAILED]	Dr. V. Shiva	Consultant / NGO director	N/a
17/05/2011	Bharatiya Krishak Samaj	Dr. K. B. Chaudhary	Farmer's Voice Editor	Yes
19/05/2011	ICAR	Dr. J. S. Sandhu	ADG Seeds	Yes
19/05/2011	DMR	Dr. Sain Dass	Director of Research	Yes
		Dr. R. Sai Kumar	Director of Research (Retd.)	Yes

9.4 Appendix 4: Example of an MOU

CHICK PEA (*Cicer arietinum L.*)

MEMORANDUM OF UNDERSTANDING

An agreement made on

Between

DIRECTORATE OF RESEARCH
JNKVV
JABALPUR, 482004
M.P.

or its successors

and the

GRAMIN VIKAS TRUST
91, Madhulkar Tower
Sardar Patel Marg
Ram Krishna Nagar
JHABUA, 457661
M.P.

or its successors

Preamble
Whereas the JAWAHARAL NEHRU KRISHI VISHWA VIDYALAYA (hereinafter called JNKVV) is recognized by ICAR, GOI and Government of MP to undertake Research, Education and Extension Education in the field of Agriculture in MP State.
And whereas the GRAMIN VIKAS TRUST (hereinafter called GVT) is actively involved in Rural Development Activities in Jhabua and Jhabua District of Madhya Pradesh State.
It is hence recognized that the JNKVV and GVT have common interest in selecting and breeding suitable **chick pea** cultivars for cultivation in the **chick pea** growing regions of MP. To this end, a collaborative research programme at JNKVV Zonal Agricultural Research Station, Jhabua is agreed upon between JNKVV and GVT. The purpose of this agreement is to undertake the work described in the attached Work Programme under conditions agreed to between the JNKVV and GVT.

Budget

GVT agrees to reimburse JNKVV for the following expenditures (Rs in Lakhs) for the work on **chick pea** crop.

S. No.	Particulars	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	Total
1	Pay and allowances	0.65	0.65	0.72	0.72	0.72	3.53
2	Medical allowances	0.05	0.05	0.05	0.05	0.05	0.25
3	Travel allowances	0.20	0.20	0.20	0.20	0.20	1.00
4	Recurring contingencies	0.75	0.75	0.75	0.75	0.75	3.75
5	Capital items	1.00	-	-	-	-	1.0
6	Workshop expenses	0.10	0.10	0.10	0.10	0.10	0.50
7	Overhead charges @ 10% total	0.28	0.18	0.18	0.18	0.18	1.00
	Grand Total	3.03	1.93	2.00	2.00	2.00	10.96

Description of S. No. Items

NOTE: An inflation rate of 10%has been used as per ICAR norms. If actual inflation deviates significantly then the budget should be renegotiated to take this into account.

1. Pay and allowances

One SRF at the scale of Rs. 5000+7.5% HRA for first two years (Fixed per Month)
Rs. 5600+7.5% HRA for next three years.

2. Medical allowances

Medical allowance at Rs. 5000/- per year per staff member

3. Travel allowance

Travel allowance of Rs. 20,000 per year (15,000/- for staff per year + 5000/- for scientist)

4. Recurring contingency as per ICAR norms

Contingency of Rs. 75,000/- per year for conducting fieldwork, P.O.L. (Fuel & Repairs) for the motor bike, seed multiplication, communication services etc.

5. Capital Items

One Suzuki 100cc motorbike, one seed cabinet, two seed bins (2q), three seed bins (1q), one spring balance, one office table, two chairs, one almirah, one seed counter and one platform balance. Total Rs. 1,00,000

6. Workshop expenses

Expenses in organizing meetings at JNKVV, Level, Group discussions Workshops, and Seminars.

7. Overhead expenses

Institutional charges in favour of JNKVV (10% of total cost).

All these Capital items, completed in all respect, will be purchased and provided for this MOU by the G.V.T.

Administrative arrangements

Conditions of employment of the SRF

The SRF shall be engaged by the JNKVV and the terms and conditions of JNKVV shall apply accordingly. Normally, GVT will not entertain or bear any excess expenditure over and above ICAR norms made in the agreement unless prior approval is taken from the GVT. The pay and allowances revision taking place from time to time as per norms shall be applicable to the SRF. However, if additional expenditure including pay and DA revision for SRF is anticipated, a proposal for additional funds may be submitted to GVT, by the Associate Director of Research, ZARS, Indore for consideration and approval.

Responsibilities of the SRF

The SRF shall be responsible for the Work Programme agreed in this MOU. He / She shall be responsible to JNKVV and shall work under the technical guidance of Principle Investigator and shall remain under administrative control of the Officer In-Charge of ZARS, Jhabua. He / She shall be reporting to him and shall perform other duties, as required by them. The work Programme shall be discussed every year in the Technical Committee and the ZCC (Zonal Coordination Committee) meeting and mutually agreed thereon. He / She will be stationed at Jhabua and will be provided a motorbike for frequent mobility to the trial sites.

Technical Committee

A technical committee shall be constituted comprising the Principal Investigator, a representative from JNKVV's Research Directorate, a representative of the JNKVV's Extension Directorate, and up to three representatives from GVT. The representatives from GVT will normally include the GVT Research Co-ordinator and the State Co-ordinated (MP). The committee shall call other experts in any other relevant discipline as and when required as a special invitee to the technical committee. The Work Programme of the technical committee shall normally meet twice a year in Jhabua, once in August prior to the September ZCC meeting for *rabi* crops and once in February at the time of the monitoring mission of the trials. Other meetings between JNKVV and GVT staff may be arranged as and when required.

Project review and reporting

The research programme shall be reviewed annually by GVT and JNKVV and a progress report shall be submitted by the Principal Investigator to the Director Research Services JNKVV and GVT Jhabua in May every year.

Budget and invoicing

The Principal Investigator shall prepare annually the budgetary plan in consultation with GVT and shall submit the same to JNKVV management for review and approval as per the normal JNKVV procedures.

The JNKVV shall send request to GVT for advance remittance maximum to 50% of the total annual cost on six monthly basis except the non-recurring cost. All the non-recurring items (Capital items) shall be purchased and provided for this MOU to the JNKVV.

Vehicle

The Vehicle provided in the Maize MOU is for the sole use of the JNKVV personnel exclusively for business related to this, or other, JNKVV/GVT collaborative projects.

Release proposals and publications

Any proposals for release and identification of **chick pea** cultivars from the PVS or PPB programme shall have JNKVV and GVT recognized as the responsible institutions. All publications from the project should be sent for approval to JNKVV/GVT Technical Committee.

Capital items
All the capital items of this project will be the property of JNKVV after completion of the project.

Principles Investigator:

Dr. N. V. Deshpande
Jr. Scientist,
Regional Research Project,
College of Agriculture,
Indore

Signatures: JNKVV, Jabalpur GVT