Dialectical Diffusion

The Rockefeller Foundation, Anil Gupta, and Interactions Between Formal Science and Indigenous Knowledge During India's Green Revolution

By

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Abstract

Dominant narratives of the green revolution focus on the top-down dissemination of technology produced by global scientific networks into developing nations, but comparatively little scholarship has been produced regarding the forms of local knowledge which were transferred during the same process. This thesis will examine several important sites of interaction between formal scientific networks and indigenous knowledge with a focus on moments of historical transition in methodology. A main contention of this thesis is that this dissemination was not just a top-down flow of Western technology into Indian villages, but was rather a dialectical process by which class interest and reductionist science moulded the interaction between disparate knowledge systems. The focus will be an exposition of changes in research methodologies pioneered by the Rockefeller Foundation's Indian Agriculture Program, the International Crops Research Institute for the Semi-Arid Tropics, and the founder of an indigenous knowledge database NGO, Anil Gupta.

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Dedicated to my parents,

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Abbreviations

CIMMYT – International Maize and Wheat Improvement Center

CGIAR – Consultative Group for International Agricultural Research

FF –Ford Foundation

FRS –Farm Systems Research

GR- Green Revolution

IADP -Intensive Agricultural District Program

IAP – Indian Agriculture Program

IARI – Indian Agricultural Research Institute

ICRISAT –International Crops Research Institute for the Semi-Arid Tropics

IIM - Indian Institute of Management

IK –Indigenous Knowledge

NABARD –National Bank for Agricultural Rural Development

PRA – Participatory Rural Appraisal

RF- Rockefeller Foundation

SAT- Semi Arid Tropics

SDC - Swiss Agency for Development and Cooperation

SFDA - Small Farmers Development Agency

UPAU – Uttar Pradesh Agricultural University

WB – World Bank

Introduction:

In 1879, Allan Ocatvian Hume published the first concise account of 19th century Indian agriculture in a report entitled "Agricultural Reform in India".[1] Grounded in an "immemorial religion of agriculture"[2] he marvels at the wealth of agrarian knowledge found in the subcontinent's villages. While Hume cautioned against overrating peasant knowledge, he noted that as far as their "non-scientific agriculture is concerned, there is little to teach them, and certainly very few European farmers could, fettered by the same conditions as our *ryots*[3], produce better, if as good crops."[4] Over a hundred years after his observations a sea change of agricultural production swept the world, propelled by new agro- technologies. In South America and Southeast Asia this phenomenon of rural transformation culminated in the late 1960's in a period referred to as the Green Revolution. Environmental activist and renowned author, Vandana Shiva, claims that this period of change decimated the wealth of indigenous knowledge found in India's countryside leaving ecological devastation and "ignorant farmers" in its wake.[5] Shiva vehemently critiques the scientific and agricultural policies which ensured that "the most hard working and... intelligent farmers were reduced to being fed as if their minds were empty minds and their soil being treated as if it was an empty container for poisons."[6] Her own political activism in agriculture was motivated by the violent changes she saw taking place in the Indian countryside as a result of the Green Revolution. In addition to the Bhopal pesticide disaster and agrarian unrest in Punjab, which she cites as the specific events demanding her involvement, she remarks that India's present levels of rural indebtedness and unprecedented farmer suicide rate remain as the legacy of this revolution.[7]

Between the comments of Hume and Shiva stretches a unique period of history which saw nations engage in the project of agricultural development. This thesis draws its evidence from a distinctive period in this development known as the Green Revolution (GR), roughly ranging from

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[1] Alan Octavian Hume. *Agricultural Reform in India. (*London: W.H. Allen and Co., 1879), p.10.
[2] *Ibid*., p.10.
[3] Hindu term for *peasant*
[4] *Ibid*., p.9.
[5] Interview with Vandana Shiva, March 23, 2011.
[6] *Ibid*.
[7] *Ibid*.

the mid 1960's until the mid 1980's, in order to investigate an era of intense international technological diffusion. This project of agricultural transformation brought formal scientific research establishments into unprecedented contact with the rural populations of the developing nations and the resulting interaction deeply shaped the nature of science and society. This sea change of rural production took place in a number of countries of the developing world at different times and in different ways. In the 1960's countries such as Mexico and India were some of the first to engage their rural populations in the immense project of technology transfer which came to be known as the Green Revolution. Other countries such as Bangladesh and Thailand began their project in the 1980's.

The common thread of the GR which united all participating counties was the process of technology transfer which saw the dissemination of agricultural technology developed by international research stations to the tillers of developing nations' soils. This process differed vastly country to country and decade to decade but empirical study of specific examples of this transfer reveals a great deal about the common assumptions guiding the international production of scientific knowledge, rural development, and class interaction. It also demonstrates the historical limitations of unidirectional models of technology and knowledge transfer. The top-down methodology of transferring GR technology proved to be ineffective, inappropriate, and injurious to rural stability. Methodological innovations seeking to enhance the reciprocal flow of knowledge gained ascendance as a response. The failure of a top-down approach of technology transfer and the rise of alternative methodologies will be this thesis' major preoccupation. It will focus on the way in which institutions and individuals strove to enhance agricultural development by adapting the research methodology which guided that process. The intention of articulating these aspects of the research process is to illuminate critical moments of bifurcation within the history of agricultural and social science as well as the resulting radical redesign of reductionist scientific practices in response to the inequalities they were responsible for initiating.

This thesis contends that the unidirectional technology transfer and agricultural development process initiated by the Rockefeller Foundation in India as epitomized by the Green Revolution signalled an important historical moment in the methodological development of agricultural science. The historical evidence presented will demonstrate that forms of knowledge production which took place outside the formal scientific network favoured by the Green Revolution and Rockefeller Foundation were increasingly incorporated into established research practices. This incorporation process unfolded unevenly within the confines of class determined power structures. The limited success of the initial transfer process, a process guided by class biased assumptions embedded in such structures, ensured that this interpenetrating incorporation resulted in shifting interpretations of local knowledge and the sources of viable agricultural knowledge over time. Specifically, the Rockefeller Foundation's efforts demonstrate two separate stages in the utilization of local or indigenous knowledge (IK). First, in the 1950's and early 60's, the Foundation supported efforts to collect and document crop varieties by supplementing purely quantitative botanical information with qualitative local knowledge pertaining to sowing, harvesting, and preparation. This initial phase represents the least sophisticated form of indigenous knowledge incorporation to be discussed and although it was used to lay the foundation for future agricultural experimentation, more energy was put towards the collection of information pertaining to plants than to people. The Foundation's priorities changed as their technology transfer program encountered limitations. This second major shift in Foundation policy in this regard came about in the late 1960's and was characterized by the large scale funding of social science research on rural inhabitants. Here, local knowledge was specifically sought and documented as the primary object of research. However, at this stage the Foundation viewed relevant knowledge from rural inhabitants as relating only to their participation in the transfer process and the market, specifically the agricultural input and credit market. Local knowledge was stripped of its qualitative character and condensed into quantitative graphs and algorithms and used to market such Green Revolution staples as chemical fertilizer, high yielding seed varieties, and credit. In this phase, the Rockefeller Foundation employed American social science methodology in the service of agricultural science to promote the production of

knowledge *about* farming households. Finally, the thesis examines a significant moment of historical transition through the work of Anil Gupta and his alternative research methods. This period of methodological transition began in the late 1970's and early 80's and its translation into practice serves to demonstrate that the incorporation of indigenous knowledge was not only required for local contextualization within the technology transfer process, but the very ways in which indigenous knowledge was produced could guide a more responsive and relevant process of technological development. In this stage knowledge produced *by* local and village sources was demonstrated to be a valuable contribution to the agricultural research process.

It is possible to view the periods of transition mentioned above as the gradual refinement of scientific practices upon reaching the limits of an initial hypothesis. It is also possible to see the indigenous knowledge collected by the Rockefeller Foundation as the appropriation of local knowledge in the service of class biased interests. However this work seeks to extend its analysis beyond these assessments and to produce a more nuanced account. The dialectical approach used in this work attempts to illuminate the contradictions guiding the process of GR technology transfer by contrasting them with the principles of dialectical knowledge production. In this sense the dialectical approach serves polemically in this work as a critique of the scientific regimes dominant in agricultural development in the 60's and 70's. The contradictions embedded in these regimes and brought to light through this critique will then be shown to be guiding influences in the development of shifting methodologies in the transfer process. This approach draws attention to technology transfer as an historical process determined by existing power structures rather than an isolated event and emphasizes the social and interactive nature of knowledge production. Another characteristic of this approach will be seen in the emphasis on methodological transitions whereby qualitative change takes place in the methods of data collection. The shift displayed by some researchers away from a singular focus on statistical quantitative data to a more socially and ecologically responsive qualitative feedback system will illustrate this point. As the technology transfer process became increasingly reciprocal the dialectic will appear as both an analytic tool of

this thesis and as a "participant within science"[8]. This is visible in the eventual incorporation of dialectical principles into farm systems research and Anil Gupta's socio-ecological paradigm. As agricultural research adapted to shifting social conditions based on the indigenous knowledge it was collecting, some of its practitioners began emphasizing the same principles of interconnection and contradiction, the relationship between part and whole, historical contingency, and qualitative change, that are at the heart of dialectics. Thus, the title of this thesis situates the interaction between science and IK during the GR as a recursively changing process whereby unidirectional methods of technological diffusion were increasingly abandoned in favour of methods which enhanced locally relevant technology generation through pluralistic, multidirectional knowledge flows. This thesis ultimately concludes that the diffusion of knowledge which took place in the GR technology transfer process was dialectical insofar as the interactions between science and indigenous knowledge systems were mutually determinant, displayed transitions from quantity to quality in data collection techniques and content, and through eventual recognition that technology transfer is a social process determined by the interactions of its constituent parts. Furthermore, class based contradictions and antagonisms at the village and the global level propelled this process, eventually creating a space for indigenous knowledge to emerge as a legitimized form of knowledge within the agricultural sciences through the mediation of these contradictions.

While this work deals with interactions between science and indigenous knowledge it does not intend to pose these categories as historically static and seeks to demonstrate the blurred boundaries between them. The term "indigenous" will be used in its broadest sense throughout this work but other terms will be used when greater specificity is required. These include local knowledge, rural people's knowledge, indigenous technical knowledge, informal science/knowledge, peasant/farmer knowledge, and traditional knowledge. It is important to note that though the term "indigenous" is used often in this work, it is never used by the either agents of the Rockefeller Foundation or by Anil Gupta. The term gained popularity in the 1980's, but in the 1960's and 70's the

[8] R.C. Lewontin & Richard Levins. *Biology Under the Influence: Dialectical Essays on Ecology, Agriculture and Health.* (New York: Monthly Review Press, 2007), p.186.

RF used the term "traditional" to refer to "non-scientific" agriculture. Anil Gupta avoided using the term "indigenous" over time and prefers the term "local" in its place. The two terms will be used interchangeably through this work. Despite its myriad meanings and blurred boundaries the term *indigenous knowledge* is practical in its inclusiveness while holding the most common currency in contemporary development discourse.[9] Furthermore, the term implies an informal system of knowledge largely influenced by geographic specificity to contrast with that of less geographically bound knowledge originating from formal scientific institutions. However, it is far from the author's intention to emphasise a static dichotomy between these two terms and evidence will be provided further on which demonstrates that what is considered global is often an appropriation of the local. Much work has already been done emphasising this concept in the era of bio-piracy and intellectual property rights. Also, much has been written regarding the reverse of the above statement, whereby rural inhabitants' "local" knowledge was conveyed using a linguistic blend of traditional cultural references, modern "bioscience", and development discourse.[10] The present work seeks to investigate the degree to which formal science also displays historical change based on its experiences in the villages. It will particularly investigate the increasing influence of social science in relation to agricultural science as this discipline was the medium of diffusion for much of the GR related IK.

The three chapters composing this thesis chronicles this methodological transition as it was refined and documented through various agricultural projects enacted at the village level in India. The first chapter situates this transition in its historical context with reference to the power dynamics which guided it. Of particular focus will be a critique of positivist tendencies within the natural sciences and the emerging role played by social science disciplines as a mediator of indigenous knowledge in the realm of foreign policy and agricultural science. The second chapter investigates the Indian Agricultural Program (IAP) of the Rockefeller Foundation with a focus on the

[9] Dweijen Mallick "Investigating Indigenous Knowledge: A Review of the Bangladesh Literature on Natural Resources" in *Indigenous Knowledge, Development in Bangladesh: Present and Future.* (ed) Paul Sillitoe.(London: Intermediate Technology Publications, 2000), p. 45.
[10] Akhil Gupta. *Postcolonial Developments: Agriculture in the Making of Modern India*. (Oxford: Oxford University Press, 1998), p. 5.

program's efforts to document sociological data from rural areas. The IAP began with a systematic nationwide campaign to collect and incorporate local varieties of foodgrain germplasm and the local knowledge pertaining to them in the late 1950's. The next decade witnessed the scientific collection of genetic material give way to the intensive mining of sociological data pertaining to credit, income, and farm viability in handpicked regions in the late 60's. This shift is made evident in examination of three social science reports compiled by the Foundation. The methodological legacy of the Foundation is explored through the following the advent of farm systems research and its application in the village level studies of the International Crops Research Institute for the Semi Arid Tropics (ICRISAT).

The final chapter departs from the Foundation to examine the application of the new methodologies emerging from the Green Revolution in the service of agricultural development. It will follow the work of a geneticist and development scholar Anil. K. Gupta by examining his innovation of a socio-ecological research paradigm. In particular, this section serves as a case study exploring a new moment in the diffusion of IK by following one influential researcher's promotion of a research theory which not only encouraged the dissemination of IK, but placed the peasant at the starting point for future research in the agricultural sciences. This section will conclude with an examination of the internationalization of his methodology in the more recent Green Revolution experience in Bangladesh and Gupta's role in establishing the indigenous knowledge database, the Honey Bee Network.

The sources from which this thesis draws its conclusions are largely based on documents produced by the research staff of international philanthropic organizations, scientific institutions, and universities. These documents were culled from the British Library, the Library and Archives of the Indian Agricultural Research Institute, the Rockefeller Archives, the archives of the Indian Institute of Management (IIM), and the personal archives of Anil Gupta. Spanning the years 1956 to 1988, they are composed of published papers produced by agricultural scientists, conference papers, internal policy recommendations, professional letters, internal memos, field survey material,

questionnaires, and published reports. An essential source is the personal field notes of Anil Gupta, which were transcribed for the first time by the author of this thesis. The majority of the documents relate to the GR within India and this country will be a primary, but not singular focus. A number of the RF documents examined were used as standard policy by the Foundation's agents in other countries and parts of the final chapter draw from Gupta's experience in Bangladesh. Together these documents are intended to provide a global historical glimpse into the process by which formal scientific networks engaged with and documented knowledge which was indigenous to the subjects of agricultural development projects related to the Green Revolution.

Chapter 1- Green Revolutionaries: Reductionist Science, Rockefeller Philanthropy, and Indian Agricultural Development

The contradictions propelling modern scientific inquiry demonstrate many of the central problems of the Green Revolution technology transfer process and therefore serve as a suitable point for departure. In particular this chapter will focus on discussion of the nomothetic practices and class biased interests embedded in formal science which will be shown to be at odds with equitable agricultural development. These structural antagonisms are effectively discussed by Immanuel Wallerstein in his critique of the modern sciences. Significantly, his world-systems analysis provides contextualization for some of the archetypal assumptions guiding formal scientific inquiry which are critical to further discussion of GR technology transfer. Chief among such assumptions is the unfaltering modernist faith in certainty.[11] This "certainty of certainty" has been demonstrated to be a "blinding and crippling"[12] premise derived from the dominant bourgeois Cartesian-Newtonian model of science. This positivist model held that through the use of reason, and of course adherence to the scientific method, one could ascertain predictable and repeatable certainty in the form of universal laws.[13] Systems subject to such laws were viewed as linear in causality, determined, finite, and tended to return to equilibrium.[14] Furthermore, from any set of initial conditions these laws, whether in physics, such as in Newton's laws of motion, or in agronomy, were supposed to reproduce the same results. This is because Newtonian mechanics describes stable systems using a nomothetic methodology in which the initial circumstances of the systems are irrelevant and unexamined. However, Ilya Prigogine, the oft quoted entropic physicist in Wallerstein's work, asserts that "stable" systems make up only a small part of physical reality. Conversely, most systems are dissipative and entropic, being propelled by their internal contradictions towards a state of instability and ultimately bifurcation.[15] Prigogine argues that in such systems small variances in the initial conditions, "which

[11] Immanuel Wallerstein. *The End of the World as We Know it: Social Science for the Twenty-First Century*. (Minneapolis: University of Minnesota Press, 1999), p.2.
[12] *Ibid*.
[13] Immanuel Wallerstein. *Unthinking Social Science: The Limits of Nineteeth-Century Paradigms.* Cambridge: Polity Press, 1995).p. 30.
[14] Immanuel Wallerstein. *The Uncertainties of Knowledge*. (Philadelphia: Temple University Press, 2004), p.72.
[15] *Ibid*., 79.

are always and necessarily particular, produce vastly different results"[16] The tendency within Newtonian mechanics to ignore the importance and complexity of such "local" conditions was a recurring theme in the generation and transfer of GR agro-technology.

Labelled, "reductionist", "determinist", and "linear" by the sociologist Wallerstein, Newtonian mechanics is similarly critiqued by two academics from within the natural sciences.[17] Richard Lewontin and Richard Levins have been outspoken critics of this epistemological tendency particularly within the biological sciences. Similar to Wallerstein's balancing act between the idiographic and nomothetic, Lewontin advocates for the need to create an analytical space between "idealistic holism" on one side and "vulgar reductionism" on the other.[18] This is the space created by dialectical materialism which he asserts "views the whole as a contingent structure in reciprocal interaction with its own parts and with the greater whole of which it is a part. Whole and part do not completely determine each other."[19] Engels 'critique of the natural sciences reminds us that while the nomothetic method allowed for great leaps in scientific discovery it has also " left us as legacy the habit of observing natural objects and processes in isolation, apart for their connection with the vast whole, of observing them in repose, not in motion."[20] Engels and Lewontin instead support a dialectical approach to knowledge, whether in the natural sciences or in philosophy. Such an approach prevents getting lost among the myriad particularities of the individual parts of a system, while also avoiding the determinist trap of abandoning the meaningful complexity of localized idiosyncrasies altogether in favour of "universal" laws. Furthermore, the dialectal approach "permits us to work with the relative autonomy and reciprocal interaction of systems on different levels."[21] In these quotes Lewontin is not only commenting on the ontological principles of complex systems, such as an organic molecule or a farm, but also on the epistemological pursuit of such phenomena. The dialectic is thus for him both a description of complexity in the world, as well as a methodology

[16] *Ibid*.
[17] *Ibid*,. 158
[18] Richard Lewontin & Richard Levins."Dialectics and Reductionism in Ecology" in *Synthese*, Vol. 43, No. 1, Conceptual Issues in Ecology, Part I (Jan., 1980), p.51.
[19] *Ibid*.
[20] Engels, Fredrich. "Socialism: Utopian and Scientific" in *the Marx-Engels Reader*. Robert Tucker (ed). (New York: W.W. Norton and Company, 1972), p. 617.
[21] *Ibid*.,p.66.

which enables that complexity to be appreciated at its various contradictory levels. Since the initial reductionist/nomothetic tendencies of the GR scientists ensured that the various levels of complexity on the Indian farm would be ignored, it is important to note that the agricultural science which evolved from that period bore many features which resembled the dialectical approach espoused by Lewontin. However, he notes that programs of agricultural research in particular fit the reductionist paradigm and have been "thwarted by the power of indirect and unanticipated causes rather than by error in the detailed description of their own objects of study."[22] An interjection from Levins illustrates this failure to grasp complex interactions when he writes that such science is simply incapable of analyzing indirect, non-linear causation, such as the impact of "capitalism on the human pancreas", or the "effects of a racist workplace on the human adrenal glands".[23] Like Levin's determinist endocrinologists, the atomized scientists on agricultural research stations perfected their separate technologies, while a myriad of unanticipated and indirect causes lay dormant in the unstudied interactions at work in the fields and villages of the global South.

Lewontin emphasizes the need to study things as they exist in a system of near incomprehensible complexity without resorting to idealistic holism. Such holism is not the opposite of reductionism, rather is another form of it which relies on assumptions about the power of quantitative statistical data to provide insight into trends within a closed system of variables.[24] That being said, he insists on the value of a science which extends its powers of observation to cover a range of causality that includes qualitative social and ecological factors. He elaborates his position by noting that "both the internal theoretical needs of ecology and the social demands that inform our planned interactions with nature require an ecology that makes the understanding of complexity the central problem; it must cope with… contradictory processes. It must become increasingly self-conscious of its own philosophy, and that philosophy will be effective to the extent that it becomes not only materialistic, but dialectical"[25] Lewontin was not commenting on agricultural research in

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[22] *Ibid*.
[23] Richard Levins. **"**Dialectics and Systems Theory" in *Science & Society*, Vol. 62, No. 3, Dialectics: The New Frontier (Fall, 1998), p. 383.
[24] *Ibid*,. p.51.
[25] *Ibid*., p.77.

particular, but this thesis intends to demonstrate that it too became increasingly self-reflective and dialectical. In fact, it is through the very neglect of qualitative social and ecological causality that led to the failures of the Green Revolution.

The notion of causality is further examined by Lewontin in his book *Biology as Ideology.* A scathing critique of reductionist science, particularly in his field of genetics, this work provides examples of his emphasis on causal complexity. In it he argues that reductionist modern science has a tendency to look for a single cause contributing to a single effect. An example would be medical science's tendency to view the disease tuberculosis as *caused* by the tubercle bacillus.[26] This is opposed to a view which also searches for causes in social or environmental factors such as the foul conditions of the crowed nineteenth century factory floor. Since tuberculosis cases were higher in such environments than among rural inhabitants or the upper classes, "we might be justified in claiming that *the* cause of tuberculosis is unregulated industrial capitalism."[27] Similarly, the plant scientists of the GR felt that if the effect was world hunger, then the cause must be plants which produce inadequate amounts of food. If the effect is that the spectacular new high yielding varieties of wheat are not being adopted by farmers then the cause must be irrational and "unprogressive" farmers.

The GR is criticised directly by Lewontin and his colleague Richard Levins for adhering to this unidirectional causation. A simple example from the GR illustrates their position. Since pesticides kill pests, their extensive use will offer protection for vulnerable foreign plant varieties. The line of causality, while plausible, fails as the same pesticides tended to kill all predatory insects in a field ecosystem while pest insects developed resistance to the chemicals. Similarly, an agricultural strategy promoted to alleviate poverty and hunger can result in "class differentiation in the countryside and displacement of peasants."[28] While the GR solved many problems in the discipline of plant breeding, the plant specialists at its helm did not incorporate lines of causation deriving from

[26] R.C. Lewontin. *Biology as Ideology: the Doctrine of DNA.* (Toronto: House of Anasi Press, 1991), p.41.
[27] *Ibid*., p.42.
[28] Lewontin & Levins. *Biology Under the Influence*, p.84.

"pest ecology, land tenure, or the rural political economy and as a result increases in production are sometimes associated with increases in misery."[29] Under the influence of reductionist logic it is no wonder that the GR scientists were astonished to see that their pesticides had the effect of actually increasing pest populations in the long term.[30]

The attitude among scientists which concludes that technology has a life unto itself "imposing its imperatives on individuals and social organization"[31] is referred to as technological determinism according to Richard Brown. This deterministic view was prevalent in the policy planning of the GR which failed to account for the way in which individuals and social organization also impact the nature of technology. The technological determinism of the GR is contrary to the Marxist view which emphasises the historical interaction between society and technology. In this view "technology and economic organization constantly reshape each other in a dialectical process."[32] The determinist path followed by GR planners and scientists would only ensure the magnification of the contradictions guiding that process. Brown's work does not deal directly with agricultural sciences, but rather another endeavour guided by the Rockefeller Foundation; the propagation of medical science. Regardless of the industry, Brown is accurate in his assertion that those individuals and groups who control the productive forces have mobilized the rationale of determinism while tending to invest in technology which is tailored to suit their class interests.

Wallerstein takes the class influence one step further in noting that science culture itself "became the fraternal code of the world's accumulators of capital."[33] In his view, this fraternity encouraged technological innovation at unprecedented rates while serving the interests of the capitalist class to which its members also largely belonged.[34] Furthermore, Wallerstein insists that the persistence and canonical status of nomothetic Newtonian mechanics is a consequence of capitalist development whereby it served as a "cultural shroud, which permitted the political

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[29] *Ibid*.,126.
[30] *Ibid*.,360.
[31] Richard Brown. *Rockefeller Medicine Men: Medicine and Capitalism in America*. (Berkeley: University of California Press, 1979). p.3.
[32] *Ibid*.
[33] Immanuel Wallerstein. *Historical Capitalism*. (London: Verson, 1983), p.84.
[34] *Ibid*., p.74.

argument that humans could indeed 'conquer' nature, should indeed do so, and that thereupon all negative effects of economic expansion would eventually be countered by inevitable scientific progress."[35] Moreover, Ramachandra Guha's ecological history of India contends that this technological entitlement was reinforced throughout the ages as the ascendance of European culture was accomplished largely with its ability to translate scientific discovery into new ways of manipulating nature. Since this manipulation was often done in the service of commodity production "along with the market...it was science and technology that became the most respected elements within the belief system of Europe."[36] Here, Guha illustrates the legacy of a largely Western ideological bias based on technological rationalization which places man above nature, as its rightful master.

The capitalist influence on science is further discussed by Marx in the *German Ideology* where he writes that the advent of "big industry" in England universalised competition and thus "made natural science subservient to capital and took from the division of labour its last semblance of natural character."[37] This "natural character" relates to man's relationship with nature and how under capitalism it was torn asunder as "all natural relationships were resolved in money relationships."[38] This alienation of man from nature is further elaborated on as an alienation of man from his labour. Since the substrate of all man's labour is the "sensuous external world", that is nature, the product of his labour is simply nature transformed. However, under capitalist relations, instead of realizing the fruits of his engagement with nature, what he produces "more and more ceases to be an object belonging to his labour."[39] This component of capitalist alienation impacts the natural scientist and the farmer alike. Additionally, nature itself is thrown into disarray under capitalist exploitation. This "metabolic rift" in man's relationship with nature is related directly to agriculture by Marx and Engels in their analysis of increasing European soil degradation. While the

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[35] Wallerstein, *End of the World*, p.84.
[36] Ramachandra Guha & Madhav Gadgil. *This Fissured Land*: *An Ecological History of India*. (Berkely: University of California Press, 1993), p. 208.
[37] Karl Marx "The German Ideology: Part 1". *The Marx-Engels Reader*. Robert Tucker (ed). (New York: W.W. Norton and Company, 1972), p.149.
[38] *Ibid*.
[39] Marx, Karl. "Economic and Philosophic Manuscripts of 1844: Selections" in *The Marx-Engels Reader*. Robert Tucker (ed). (New York: W.W. Norton and Company, 1972), P.58.

application of science and technology to the art of agriculture had the effect of increasing production, it also "disturbs the metabolic interaction between man and the earth"[40] within the context of capitalist production. The natural interaction between man and nature was interrupted by the exploitative interests of capital as applied through industrial technological processes. In this regard Marx states that:

> All progress in capitalist agriculture is a progress in the art, not only of robbing the worker, but of robbing the soil; all progress in increasing the fertility of the soil for a given time is a progress in ruining the more long lasting sources of that fertility...capitalist production, therefore, only develops the techniques and degree of combinations of the social process of production by simultaneously undermining the original sources of all wealth –the soil and the worker.[41]

Documents from the GR to be discussed later will demonstrate the persisting poignancy of Marx's words as they relate both to social and ecological conditions. These documents will also serve to highlight the depth of wealth, particularly in the form of knowledge, which was undermined through the promotion of a technocentric and class biased, mode of agricultural production.

Brown's critique of Rockefeller Foundation science stems from its class bias. Specifically, "in the case of medicine, members of the corporate class, acting mainly through philanthropic foundations, articulated a strategy for developing a medical system to meet the needs of capitalist society. They believed their goals for medicine would benefit society as a whole, just as they believed that the private accumulation of wealth...was in the best interest of society".[42] While his focus is on the medical sciences emerging from the Progressive Era, later engagement with RF documents will demonstrate that his comments remain accurate in describing the Foundation's attitudes in agriculture a half century later. Whether, medical or agricultural, it is apparent that "science was helping industry reshape the organization of production by developing machinery to control and

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[40] John Bellamy Foster. *The Ecological Revolution: Making Peace with the Planet*. (New York: Monthly Review Press, 2009), p.229.
[41] Fred Magdoff & John Bellamy Foster."Leibig, Marx, and the Depletion of Soil Fertility: Relevance for Today's Agriculture" in *Monthly Review: Hungry for Profit: Agriculture, Food, and Ecology.* Vol 50, No3. (1998), p.38.
[42] Brown. *Rockefeller Medicine*. p.4.

cheapen human labour and more cheaply extract from nature a saleable product".[43] In agriculture this machinery was the newly developed seeds and chemicals which propelled the GR, but the desired effect was the same. This class bias which favoured substituting capital for labour in an effort to rapidly increase production ensured that the diffusion of some innovations was preferred over others. In particular, capital intensive technologies, such as chemical fertilizer and pesticide, rather than labour intensive technologies were encouraged. Linking Brown, Lewontin, Levins, and Wallerstein is the notion that the nomothetic/reductionist tendencies within science were not simply the result of the failure of reason or scientific rigor, but were rather the result of a 19th century European bourgeois heritage, steered by a "fraternal code" of accumulators towards the commodification of nature while justifying this process as progressive and innovative to the extent that it served capital accumulation. As a more detailed investigation into the GR will reveal, such innovations procured benefits for the interested classes while neglecting or damaging the broader needs of the global citizenry, especially small peasants. Istvan Messzaros relates how any increase in the powers of production simultaneously increases the potential powers of destruction, perpetuating uneven development.[44] In this light, technology does not play a neutral role in historical development, but rather an inherently problematic one. For this reason, Meszaros levels his critique at the natural sciences, "in the name of which the ideologies of technological manipulation legitimate themselves."[45] The natural sciences, while boosting the metabolic rate of man's relationship with nature, "has a gravely problematic side that is ignored by all those who counterpose their positivistically idealized 'science' to ideology' *tout court".* For Meszaros, the destructive manifestations of the natural sciences and the ideologies used to rationalize technology's consequences are "devastatingly enhanced and multiplied by its embeddedness in a class society, articulated in the service of the rulers so as to secure permanent subjugation of the dominated."[46] However, the contradictions inherent in class biased technologies served to "generate new social

[43] *Ibid*., p.121.
[44] Meszaros, Istvan. "Dialectical Transformations: Teleology, History and Social Consciousness" in *Dialectics for the New Century*. Bertell Ollman, and Tony Smith (eds). (New York: Palgrave Macmillan, 2008), p 142.
[45] *Ibid*.
[46] *Ibid*., p.143.

forces that modify technology and political-economic relations".[47] Like the Kurdish proverb, the destructive capacity of technology is thus like the arrow that once fired, returns against the archer who released it. This dialectical interaction ensures a continuous remodelling of both technology and social relations, as the empirical evidence will later demonstrate.

The dialectical interaction described first by Marx becomes more apparent in examining tangible examples of the evolution in the research methodology to emerge from the Green Revolution. As the technological determinism imposed by a reductionist scientific culture began to increase tensions in the countryside rather than alleviate them, alternative methods were sought. In India, the limitations of the GR technology were apparent by the early 70's, as was the uneven nature of the capital accumulation it had encouraged. This in turn led to strategies which changed the nature of that technology and the research methods used to develop it. This involved a self-critical review of previous methodologies and their revision in response to changing rural social relations and poor technological adoption. The promoters of the GR could not accomplish this revision if they were not more acutely aware of the specifics of these social relations and thus the natural sciences were forced into an alliance with the social sciences.

This transition is a critical moment for the dialectical diffusion of knowledge insofar as it represents a bifurcation within one field of modern science away from Newtonian determinism and towards a science of complexity. Recently, complexity studies have assaulted such dominant scientific paradigms, especially as described by Prigogine in physics. But this assault has called into question all realms of knowledge production, and especially the 19th century divorce between the social and natural sciences.[48] It has granted a space for scholars to appreciate "that the social world is intrinsically an uncertain arena"[49] and created an openness for an interdisciplinary relationship to emerge between these two realms of knowledge. This will later be demonstrated to be the case in the agricultural sciences particularly. However, the simple inclusion of social science research into the GR agro-science technology machine would not ensure that all Newtonian or class biased traits

[47] *Ibid*. p.3.
[48] Wallerstein. *Uncertainties of Knowledge*. p.22.
[49] *Ibid*., p.23.

would be abandoned. In fact, Wallerstein claims that the social sciences are often no better than natural sciences regarding their drive towards generalization, bourgeois influence, and their desire to establish universal laws of human behaviour. This is especially evident in the historical development of economics, political science, and sociology, or the "nomothetic trio", as Wallenstein refers to them.[50] This trio primarily sought out objective and empirical data, which in practice often worked out to quantitative data. In effect these nomothetic social sciences sought to exclude data which was "interpretive" or non-replicable so as to increase the validity of their claims to certainty and to "laws" of human nature.[51] Wallerstein describes the "empirical thrust" of these social sciences as being a "nationally based...way of circumscribing the study of social change that would make it most useful for and supportive of state policies".[52] Furthermore, the cultural Darwinism of the nineteenth century ensured that social science was able to play a key role in the imperialist brand of social change, whereby it could serve the colonizers by "describing unchanging customs, thereby opening the way to understanding how this other world could be brought into `civilization`."[53] The social sciences are thus regarded by Wallerstein as having been largely employed in the service of capitalist reformism and as a bourgeois "instrument of intelligent governance"[54] which limited the range of potential change a given society could go through. The inclusion of social science into GR planning was therefore not in itself a guarantee of progress. In this light then, it is not surprising that the Rockefeller Foundation was a pioneer in the social science realm. Their support of nomothetic social science research in the Indian Agriculture Program set a precedent in the late 1960`s and will be a major focus of the next chapter.

To return to the GR, the revision of methodology into a new interdisciplinarity was an awkward process in some instances. An interesting example illustrates the separation in thinking between the international capitalist class under the guise of international philanthropy and the international scientific institutions founded by this class. In 1974, as the gains of the GR reached a

[50] Immanuel, Wallerstein. "Social Science and the Quest for a Just Society" in *the Essential Wallerstein*. New York: The New Press, 2000), p.191.
[51] *Ibid*., p.194.
[52] Wallerstein, *Unthinking Social Sciences*, p.20.
[53] *Ibid*.
[54] *Ibid*.

plateau, the RF initiated and funded a worldwide social science fellowship program.[55] This programme brought some of the brightest social science PhD graduates into the regional centers of global Consultative Group for International Agricultural Research (CGIAR) in an effort not only to influence a generation of more socially responsive technology over the short term, but also to send a hint to the managers of such institutions that a new norm was being established in international agricultural research.[56] Rockefeller funding had been strategically directed toward social science innovation since at least the 1920's when new theories regarding the potential for "human engineering" were in vogue.[57] The advent of these attitudes in agricultural development took until the 1960's. In addition to contributing directly to the generation of socially sensitive technology, these "Rocky docs" were intended to normalize relations between biological and social scientists over time and encourage the CGIAR centers to concertedly establish permanent positions for future PhD graduates.[58] The program ran until the mid 90's when RF support was withdrawn and redirected, yet despite its success the GCIAR consistently reduced the funding and size of its own social science programs while poorly incorporating the research efforts of the Rocky docs. This example documents the impact of the GR on Rockefeller Foundation policy insofar as it demonstrates the organization`s appreciation of the limitations of nomothetic natural science and its attempt to offset this limitation by a sustained foray into interdiscplinarity, even though the venture was ultimately rejected by the CGIAR.

Resentment regarding the CGIAR neglect of the RF's fellowship program is captured by Michael Cernea, the former Senior Sociologist of the World Bank (WB) and member of the Technical Advisory Council for the CGIAR. Cernea, who was instrumental in influencing the WB's social science engagement with agriculture, asserts that "any centre manager or scientist in an international research center who...downgrades or leaves out from research agendas the study of these

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[55] Michael Cernea. "Rites of Entrance and Rights of Citizenship: The Uphill Battle for Social Science Research in CGIAR" in *Researching the Culture in Agri-Culture*: *Social Research for International Development*. Michael Cernea and Amir H. Kassam (eds). (Wallingford: CABI Publishing, 2006), p.12.
[56] *Ibid*.
[57] Rebecca Lemov. *World as a Laboratory: Experiments with Mice, Mazes, and Men.*(New York: Hill and Wang, 2005), p.56.
[58] Cernea. "Rites of Entrance", p.13.

fundamental social-cultural components, ends up with an incomplete grasp on reality and undermines his individual, and his institution's performance."[59] Cernea's "ontological" argument here is that agricultural development cannot take place outside an appreciation of its essential "cultural" components.[60] This runs contrary and in direct response to the technological determinism inherent in earlier GR policies. Cernea attempts to correct the trend he sees in the CGIAR by citing a number of tangible examples of social science contributions to agricultural policy within the CGIAR. These include encouraging techniques of farmer to farmer knowledge exchanges, farmer-led participatory plant breeding, and gender studies related to agro-forestry.[61] However, he contends that "the *methodological contribution* that social researchers have made- and keep making-to the research methods of the CGIAR's entire scholarly family is enriching and has the *most* impact."[62] This is exemplified in the development of participatory research methodologies in the biological sciences of the CGIAR. This participatory methodology, also called Participatory Rural Appraisal (PRA), employs "techniques for learning about rural life and conditions from, with, and by rural people. PRA supports the direct participation of communities, with rural people themselves becoming the main investigators and analysts. Rural people set the priorities; determine research needs; select and train community researchers; collect, document and analyze data; and plan and implement solutions based on their findings."[63] It requires a decentralized research network to diffuse power to the peripheral actors such as extension staff and marginalized small farmers.[64] It also encourages the inclusion of innovative practices outside the research agenda, pioneered by the farmers themselves. PRA thus represents the culmination of the dialectical diffusion of indigenous knowledge in theory and praxis by establishing a two way power structure for research processes which promotes various levels of input from local actors. In the late 80's indigenous technical knowledge first began to be systematically documented and promoted using PRA by the nongovernmental organization, the

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[59] Michael Cernea. "Preface"in *Researching the Culture in Agri-Culture*: *Social Research for International Development*. Michael Cernea and Amir H. Kassam (eds). (Wallingford: CABI Publishing, 2006), p.7.
[60] *Ibid*.
[61] *Ibid*., p.8.
[62] *Ibid*.., p.9. (emphasis added)
[63] Louise. Grenier.*Working with Indigenous Knowledge: A Guide for Researchers.* (Ottawa: International Development Research Center, 1998), p.42.
[64] L Sperling, & J Ashby. "Participation in Agricultural Research Planning" in *Planning Agricultural Research: A Sourcebook*. (eds) G Gijsbers, W. Janssn, H. Hambly Odame, G. Meijerink. (Wallingford: CABI, 2001), p.172.

Honey Bee Network (HBN), founded by Anil Gutpa.[65] One of the first organizations of its kind in the world, the evolution of the HBN is a telling account of the challenges and intricacies of indigenous knowledge diffusion.

PRA methodology emerges in the late 1980's as the culmination of decades of evolving research practices and remains common currency in agriculture development circles to this day.[66] PRA encourages a dialogue with the subjects of rural development which includes an open discussion of a viable "menu of options" for farmers ranging from choices in genetic material to practices and principles, rather than the top down imposition of a predetermined package of inputs as was promoted during the GR. In language reminiscent of Lewontin and Levins' critique of unidirectional causality, PRA is contrasted by one of its practitioners with the technology transfer model of the GR, which is criticised for its reliance on "a conventional view of science, in which science is seen as dealing with universality, deterministic laws of causality... and a narrow, ends-means notion of rationality".[67] The previously dominant transfer of technology model is further accused of being "ahistorical" and "asocial", while being "epistemologically different" from the participatory approach.[68] The participatory approach embraces an "historical and turbulent view of nature and society" in which positivist generalizations are shed for a perspective which implies that "neither nature nor society can be understood independently of the other."[69] These passages illustrate the dialectic emphasis on the complexity of interactions, including social interactions, and the need to approach knowledge production as a historical process. However, this methodological transformation did not happen overnight and a closer examination of its historical development will remain a thematic focus of this thesis.

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[65] Mike Collinson, "The Applications of Farming Systems Research". in *A History of Farm Systems Research*. (ed) Mike Collinson. Rome: Food and Agriculture Organization, 2000. p.84.
[66] Michael Drinkwater."Knowledge, Consciousness and Prejudice: adaptive agricultural research in Zambia", in *Beyond Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice.* Eds. Ian Scoones, and John Thompson.(London: Intermediate technology Publications, 1994), p.33.
[67] *Ibid*.
[68] *Ibid*.
[69] *Ibid*., p.35.

The advent of PRA was brought on by increasing concern as to the reliability of data generated at the village level, as well as concern over the methodologies which guided this data collection.[70] Robert Chambers, particularly critiques the use of questionnaire surveys noting that the framework provided by such a format limits the potential of relevant data to be generated and guided by local conditions.[71] The limitations of such questionnaires will be demonstrated in the sections to follow with a critical review of a number of questionnaires used by the Rockefeller Foundation and the ICRISAT. Chambers notes that there are often discrepancies in the data generated by conventional research methods and that of PRA since participatory approaches tend to enable the "expression of local complexity".[72] Such expressions of complexity were seen to be a necessary requirement for relevant technology generation since it is this same complexity that farmers confronted in their own decision process. Chambers cites a study done in India regarding varietal selection criteria to illustrate this point. Here, a matrix scoring of wheat varieties was done separately by researchers and farmers. Each was asked to point out the criteria which affected their choice of wheat variety for sowing. While the researchers predictably picked such characteristics as higher yield and pest resistance, the farmers' priorities differed greatly. Less obvious characteristics, such as seed which did not shatter, guided the farmers' decisions and did not even register on the researchers' lists.[73]

For Chambers, an emphasis on alternative systems of knowledge is a key component to the generation of relevant technology. Among a plurality of knowledge systems, science is only one, albeit the most "powerful and universal".[74] Rural peoples' knowledge in contrast is "'situated', differing both by locality and by group and individual, and differing in its modes of experimenting and learning".[75] The marginalization of this knowledge has come at the hands of scientific establishments linked with "local elite", who can range from large landowners, to "progressive"

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[70] Chambers, Robert & Henman, Vanessa "Participatory Rural Appraisal" –Planning Agricultural Research: A Sourcebook. Eds G Gijsbers, W. Janssn, H. Hambly Odame, G. Meijerink. (Wallingford: CABI, 2001), p.296.
[71] *Ibid*.
[72] *Ibid*.
[73] *Ibid*., p.297.
[74] Chambers, R." Forward" in *Beyond Farmer First: Rural People's Knowledge, Agricultural Research and Extension Practice*. Eds. Ian Scoones, and John Thompson. (London: Intermediate Technology Publications, 1994), p.XIV.
[75] *Ibid*.

farmers, to less poor farmers, to male farmers relative to female, according to Chambers. This marginalization also takes place outside of local contexts by international and national elites such as governmental minsters, planning officials, Rockefeller Foundation staff, and the private corporate class. For such monopolies of knowledge to be broken, greater emphasis on knowledge *as a process* must be engendered.[76] The debate has tended to get stuck on "whose" knowledge is used, rather than on how that knowledge is created, who has access to it, or what endogenous/exogenous conditions contributed to it. The work of non-governmental agencies and individuals in this regard has been crucial due to the institutional shackles which bind certain state agencies from releasing their grasp of monopolized knowledge. The examination of the work of Anil Gupta in the third chapter will further illustrate the importance of the development of this unhindered professionalism which focused on the "bottom up articulation of needs".[77]

Central to the historical development of a participatory agricultural research methodology is the development of farm systems research (FSR). FSR loosely refers to an assembly of methods used by researchers to understand agriculture as a vast system of complex interactions rather than as a set of mutually exclusive variables each with their own independent logics.[78] It comes from the desire to appreciate the complexity of farm level interactions, which was a common thread in systems theories in the late 60's and early 70's. Mike Collinson, a former social science adviser to the CGIAR, describes FSR as an:

> innovation in the research process, emerging from field practitioners, an early effort to bridge the gap between the needs and capacities of small, resource poor farmers and publicly funded agricultural research establishments... common thread through the different accounts leave no doubt that in the 1960's and early 1970's the same problem was widely identified across the developing world; technologies recommended as a result of agricultural research investments were, in general inappropriate to the priorities and circumstances of small farmers. Field practitioners recognized the importance of the problem and targeted a better understanding of small farmers and the way they make decisions, as a path to its solution. Their concern for appropriate improvements for small-scale, illiterate, and resource poor farmers was the origin of FSR and remains its foundation.[79]

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[76] *Ibid*.
[77] *Ibid*., p.XIII.
[78] Mike Collinson. "Introduction" in *A History of Farm Systems Research*. (ed) Mike Collinson. (Rome: Food and Agriculture Organization, 2000), p.1.
[79] *Ibid*., p.2.

Several key points need to be highlighted from this selection since they will resurface a number of times in this thesis. The first relates to its criticism of the package of technologies which were promoted during the Green Revolution in the 60's and 70's. These technologies were identified as "inappropriate" for the majority of farmers. The incorporation of social science data which contributed to a better understanding of farmers' decision making process was the only way to resolve such irrelevancies. Finally, this perspective was advanced by those researchers who conducted their work in the field rather than isolated in the laboratories of large agricultural research stations. The historical evidence presented in the following sections will chronicle the influence of these same elements; diffusion of inappropriate technology, on-farm field experience, and the incorporation of farmer knowledge.

British Science and the Institutionalization of Agricultural Research

Before settling into a discussion of India's post independence era, which will occupy the remainder of this work, it will be useful to briefly highlight some of the first historical interactions between formal science and the informal science of the Indian countryside. This will serve the purpose of situating modern themes and contradictions in a framework of historical continuity in addition to illuminating historical change. Several prominent scientists of the British Raj compiled detailed accounts of these experiences and represent the first systematic surveys of agriculture on the subcontinent. These accounts provide a stark contrast to the assessments compiled by the Green Revolution scientists and such contradictions establish a context for viewing the later condescension of the Rockefeller and IARI scientists. The British agriculturalists present some of the richest recollections of traditional Indian agriculture and since they were made before large scale state intervention, institution of the Zamindar system of landholding aside, these observations further serve to demonstrate the close proximity between the forces of European and India agricultural production less than a hundred years before the dawn of the GR.

In an illustration of Marx's notion of natural science's obedient relationship to capital, the impetus towards the first foreign intervention in Indian agriculture came not from basic scientific concern but rather from "big industry". The American Civil War had severely disrupted cotton supply and a number of Manchester textile industrialists sought to secure supply from India. In 1863, the Cotton Supply Association of Manchester exerted pressure on the Secretary of State in India to devise a way to improve British access to cotton and a permanent institution in the country was proposed as the best way to accomplish this.[80] Formal agricultural research centers were a relatively new phenomenon even in Europe with the first being established in Mockern, Germany in 1852. The model was rapidly emulated by Britain, Australia, Japan, and the USA.[81] No such institution would be established in India until 1905 when the Imperial Agriculture Research Institute was constructed in Pusa, on the outskirts of New Delhi. In 1871, a full century before the climax of the Green Revolution, Lord Mayo of Her Majesty's Government in India appointed Alan Octavian Hume to the post of chief secretary of the newly established Department of Revenue, Agriculture and Commerce. The original title was supposed to contain only reference to agriculture, but government officials thought that 'revenue' should be the main focus. [82] Hume notes that "though originally designated the Department of Agriculture...this department had never, from the first, been so constituted as to permit of its dealing either directly or efficiently with agricultural matters."[83] Hume, a theosophist, ornithologist, naturalist, and amateur farmer had been in India for many years and had a passion for the betterment of India's rural inhabitants. Towards this end he set up 181 schools in various districts of the country.[84] As the secretary of the new department Hume began a review of the current state of agriculture in India. Comments contained in M.S. Randhawa's exhaustive five volume *History of Agriculture in India* reveal Hume's experiences with India's peasantry and represent some of the earliest scientific observations relative to indigenous knowledge:

> The tradition and experience of three thousand years have given them minute knowledge with regard to their own ancestral holdings... they know to a day when it is best to sow each

[80] M.S. Randhawa. *A History of Agriculture in India*, *V*ol 3. (ICAR: New Delhi, 1983), p.178.
[81] *Ibid*., p.175.
[82] *Ibid*., p.183.
[83] *Ibid*.
[84] *Ibid*., p.172.

> staple and each variety of each staple...As for weeds, their wheat-fields would, in this respect, shame ninety-nine hundreds of those in Europe. So far therefore as what may be called non-scientific agriculture is concerned, there is little to teach them...on the other hand, we must not overrate their knowledge; it is wholly empirical, and is in many parts of the country, if not everywhere, greatly limited in its application by tradition and superstition.[85]

Hume's initial recommendations included the need for a competent agriculture department as well as the proliferation of veterinary clinics to attend to the high mortality rate of cattle during the dry months. His own department however, was never able to hire any scientific officers and it maintained a limited collection of statistics, having neither land, money, or staff to affect much change.[86] Hume was eventually removed from his post due to his Indian home-rule sympathies and demoted to a staff position unrelated to agriculture.

A great famine struck India in 1876-78 which affected 60 million people, and resulted in the death of 5,250,000. It led to the famine commission of 1880 and marked a renewal of interest in agriculture by the British. It also led to the establishment of the Central Department of Agriculture which administered newly established departments in every state of the country.[87] In 1889 this Central Department requested an English chemist in order to assist in the application of the teachings of "agricultural chemistry" to India and initiate improvements in Indian agriculture. The chemist chosen was John August Voelcker. A consulting chemist to the Royal Agricultural Society of England, he arrived in India in 1889 and left the following year. He spent the time in between surveying the countryside and compiling his landmark *Report on the Improvement of Indian Agriculture*.[88] This is the first country-wide survey to have been produced by a career scientist. Its attitude towards the traditional practices of Indian farmers is favourable yet not without criticism. Regarding the role of British science Voelcker comments:

> If I am asked whether the agriculture of India is capable of improvement, I must answer both "yes" and "no". If for instance I am taken to see the cultivation of parts of Gujarat, Bombay, of

[85] *Ibid*., p.183.
[86] *Ibid*.
[87] *Ibid*., p.233.
[88] John Voelcker, "Report on the Improvement of Indian Agriculture". (London: Eyre and Spothswoods, 1893), p.296

> Mahim in the Thanna district of Bombay, the garden culture of Coimbatore in Madras, or that of Meerut in north West provinces...I may be inclined to say, 'no'; there is nothing, or , at all events, very little that can be bettered here... At his best the Indian *raiyat* or cultivator is quite as good as, and in some respects the superior of, the average, British farmer, whilst at his worst it can only be said that this state is brought about largely by an absence of facilities for improvement which is probably unequalled in any other country, and that the *raiyat* will struggle on patiently and compliantly in the face of difficulties in a way that no one else would. Certain it is that I, at least, have never seen a more perfect picture of careful cultivation, combined with hard labour, perseverance and fertility of resource, than I have seen at many of the halting places in my tour.[89]

His comparison with British farmers is especially interesting considering the climate of colonial condescension which underscored British rule in India. One wonders how, if even the basic implements of the late nineteenth century were lacking, later farmers were supposed to acquire and make use of high technology and mechanized inputs of the GR period.

Voelcker noted a great disparity in agricultural ability which was determined by caste. For example, *Jats* were capable manual labourers and were inclined to be productive cultivators, while the *Raiputs* and *Brahmans* preferred to hire outside labour to work their land. He commented that the removal of caste barriers would be followed by improvement in production since many caste based taboos prevented an impartial agricultural approach.[90] Since many of the castes specialized in certain kinds of farm operations it could increase the income options for farmers if they were not restricted from diversifying their production. Voelcker includes the example of how beneficial it may be if the *Raiput* or the *Brahman* could see that there was nothing "derogatory" in manual labour and that the use of "night time soil", as was practiced by the *Kachhis*, could increase soil fertility. In none of the GR documents studied did an agricultural scientist comment on the limitations of caste. Where it is mentioned in GR social science reports it is included as no more than a demographic statistic.

The report recommended a more thorough and systematic inquiry into Indian agriculture. Such information should be incorporated into a new agricultural education system overseen by a

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[89] *Ibid*.
[90] *Ibid*.

permanent resident expert, who was not an administrator, but rather a scientist.[91] To this end he commented that "It would proceed on the right lines when dealing with Indian agriculture, viz, to improve it from within, and by means of its own examples, rather than by bringing foreign influences and methods to bear upon it...a cultivator in one, or better still, in the same village, can act as an example to another elsewhere."[92] Had this prophetic quotation been seriously meditated upon by later generations it is possible that a good deal of time and trouble could have been saved during development projects. Its scepticism of foreign methods, recognition of the potential for improvement from within, and acknowledgment of the principle of farmer to farmer emulation will be lessons which would take over a hundred years to fully understand. In 1889 however, the wheel of history was still a long way from coming full circle.

It was Voelcker's impartiality and willingness to enter the villages and interact with the tillers of the soil which granted him such insights into the nature of cultivation in India. His anticipation of participatory research approaches warned of the dangers of GR scientific reductionism. This is reiterated in the following insightful excerpt:

> 'Practical enquiry' , or the obtaining of knowledge respecting agricultural practice, precedes both scientific enquiry and experiment. The scientist, without some knowledge of the practical issues involved, is unable to push his enquires in the right direction, and however able his researches, he may fail from being unpractical. Similarly, the experimenter without a knowledge of what is done elsewhere, or of what is within the reach of the cultivator, may waste both time and money in trying what has no chance of ever becoming of any practical value...Real progress came only when it was realised that in India, agricultural practice has been built up on the traditional custom of years, and in which reside, though unexpressed and unexplained, deep scientific principles, the reasons for which can only gradually be elucidated.[93]

It was this clarity of observation and appreciation of local farmer knowledge regarding practical problems and solutions which allowed for such nuanced accounts to emerge from a period which was otherwise rife with colonial condescension. Both of these critical factors would be noticeably

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[91] *Ibid*.
[92] Randhawa, *Indian Agriculture*. p.234.
[93] *Ibid*., pp.20-23.

absent as the architects of the Green Revolution drew their blueprints for a new era of agricultural modernization.

International Origins of the Green Revolution: Malthus, American Experience, Nationalism, and the Cold War

India's Green Revolution was a process decades in the making and came to fruition due to a myriad of complex and interwoven motivations. Akhil Gupta advances three prominent overarching themes which contributed to its particular impact on India; nationalism, normalization of the American experience, and Malthusianism. In much of the developing world advancement of agriculture "was conceived entirely in national terms; indeed, the nation constituted the horizon within which all problems were posed and solutions offered."[94] The nationalist guided development decades following postwar independence coincided with what, Ramachanra Guha calls the age of "ecological innocence".[95] This period saw national economic and agricultural development pursued unconstrained by ecological considerations. Any discourse which distracted from the national task of capital creation was seen as "irrelevant at best, and at worst as a dangerous deviation."[96] This emphasis was reinforced by a Malthusian spectre cast in nationalist terms which alarmingly contrasted national production of foodgrains against raising national populations.[97] Whether in Mexico or India, discourses on hunger were framed by the state as a national issue, rather than as one pertaining to specific groups of disenfranchised people.[98] Furthermore, questions of national sovereignty in foodgrain production became an issue of national security and pride in the postcolonial state. In India, dependence on foodgrain imports from Pakistan and the US led to uncomfortable national compromises, such as the elimination of such imports during war with the former country and the forced devaluation of the rupee imposed by the later. It was vulnerability in

[94] *Ibid*., p.56.
[95] Ramachandra Guha. *Environmentalism: A Global History*. (New York: Longman, 2000), p.66.
[96] *Ibid*.
[97] Randhawa, *Indian Agriculture*. p.56.
[98] *Ibid*.

this regard as well as a very real experiences with famine, as in the Bengal famine of 1942-43, which prompted Jawaharlal Nehru to remark in 1947 that "everything else can wait, but not agriculture."[99]

Advances in agricultural chemistry, mechanization, and agronomic techniques in Europe and the US made agricultural progress appear to be a rapid and orderly endeavour, ecological costs aside. The gains in production and rural income as well as the freeing up of labour for industrialization in the cities were viewed as the desirable accompaniments to agricultural and indeed national modernization. This was all part of the teleology of modernization whereby the economic development of the West was thought to be the "normal" process by which one entered the "consumer heaven" of developed nations.[100] The "mythic narrative" of the universal applicability of European development was conceived by many, especially those among the dependency theorists, to be a legacy of the questionable Enlightenment faith in progress.[101] Rather than regarding asymmetric development as being a structural component of capitalism, modernization theorists insisted that the application of science and technology would level any initial disadvantage. On this capital paved journey into modernity tough political questions such as land reform were either ignored or dismissed altogether, such as in the account written by the "three sages" of Rockefeller Foundation regarding their work in agricultural modernization. In *Campaigns Against Hunger*, E.C. Stakman, Richard Bradfield, and Paul Manglesdorf write of the limitations of land reform. These beneficiaries of Rockefeller largesse reference the Mexican Revolution's failure to increase agricultural production. They observed, "land redistribution was satisfying the hunger of the landless for land, but was it satisfying their hunger for food?"[102] Furthermore, they insisted that the rapidity of population growth in Mexico demanded equally rapid increases in agricultural output, a "revolution" in fact.[103]

The population pressure noted by the RF advisory staff leads to Gupta's most pervasive theme influencing India's Green Revolution, an unabashedly Malthusian view of the developing

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[99] M.S. Swaminathan. "Agriculture Can't Wait". *The Hindu*, May 24th, 2006.
[100] Gupta. *Postcolonial Developments*. p.64.
[101] *Ibid*., p.65.
[102] E.C, Stakman, Richard Bradfield & Paul Mangelsdorf. *Campaigns Against Hunger*. (Cambridge: The Belknap Press of the Harvard University Press, 1967), p.1.
[103] *Ibid*., p.4.

world. For the influential adherents of the "population-national security theory", an uncritical neo-Malthusianism "posited a linear linkage between overpopulation, hunger, and a resultant political instability and susceptibility to communist subversion."[104] A victory in the "race" between food production and an exponentially growing population was needed to prevent the radicalization of the Third World masses and only thought possible through the application of technology.[105] The eternal saviour of modernity, technology, was promoted on two fronts to counter the ticking "population bomb"; birth control and food production.[106] Many powerful capitalist dominated organizations and individuals mobilized their resources towards this end including the Carnegie Corporation, the Rockefeller Foundation, the World Bank, the UN, and the US State Department. In 1952 John Rockefeller III also founded a group called the Population Council to tackle the demographic transition of the decolonizing nations.[107] A newly independent India was regarded by most demographers as the most pressing concern and much work was dedicated to funding demography work there.[108] Referencing a pilot project testing birth control methods on Punjabi peasants, the Population Council staff referred to India as "the cauldron in which mankind shall be tested".[109] The social scientists providing the supporting data, such as sociologists, demographers, and economists, were naively insistent that their adherence to a "scientific approach", which relied on empiric quantitative data, ensured that their statistical collection was free from any political or class bias.

Social science's quest for objectivity demanded it appear to be unhinged from moral and political influences, lest the nomothetic desire to assert universal truths of human behaviour be called into question. This need for objectivity is why Rockefeller III insisted that the work of the Population Council "could not be overtly linked with a Cold War agenda".[110] Propelled by neo-Malthusian fears, the population control work done by the Rockefeller Foundation, along with the

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[104] Perkins, John. *Geopolitics and the Green Revolution: Wheat, Genes, and the Cold War*. *(*Oxford: Oxford University Press, 1997), p.260.
[105] Gupta, *Postcolonical Developments*. p.54.
[106] Paul Ehrlich. *The Population Bomb*. (New York: Ballantine Books, 1968). p.95.
[107] Michael Latham. *The Right Kind of Revolution*: *Modernization, Development, and US Foreign Policy from the Cold War until the Present.* (Ithaca: Cornel University Press, 2011), p.99.
[108] Mathhew Connelly. *Fatal Misconceptions: the Struggle to Control World Population*. (Cambridge: Belknap Press of Harvard University Press, 2008), p.169.
[109] *Ibid*., p.171.
[110] *Ibid*., p.165.

Ford and Carnegie Foundations, effectively legitimized demography as a "science", and contributed to the postwar policy influence of the social sciences in general.[111] Furthermore, the foundations' funding institutionalized this social "science" discipline after the mid 1950's and ensured its enduring influence on agriculture and policy makers, both in the West, and among the developing nations. In this postwar period a relatively small group of experts, primarily in the US, but also in Britain and India, developed a new modernization discourse which "codified a shared set of assumptions about how population dynamics worked, how the phenomenon was to be studied and, most important, the terms under which intervention was appropriate."[112] The resultant "ideology of overpopulation" is critiqued by Utsa Patniak for emphasizing rising "nominal" populations without considering the pressures of "real" or "effective" populations, which take into account total resource consumption.[113] So while the "scientific" work of demographers counted increases in hungry mouths in the South, the exponentially higher consumption patterns of the less populous Western nations placed far greater strains of the world's resources.[114] However, Western, and especially American strategists neglected any discussion of food consumption/distribution and instead, "the theorists targeted aggregate yields. High-yielding production systems solved that problem. Of course hunger was left untouched because all along hunger had been primary a problem of distribution, not aggregate physical supplies."[115] This oversight of postwar planners was rendered irrelevant by the Cold War ideology which, despite the insistence of the social scientists, was ultimately at the root of the population scare.

Despite its vocal assertions of political neutrality, the Rockefeller Foundation was intricately tied to American cold war politics and worked feverishly behind closed doors to further globalized capitalist relations in general and American interests in particular. The Foundation and the Rockefeller family had close ties to the US State Department and many of the top Foundation staff

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[111] John Sharpless. "Population Science, Private Foundations, and development Aid: The Transformation of Demographic Knowledge in the United States, 1945-1965" in *International Development and the Social Sciences: Essays on the History and Politics of Knowledge.* Frederick Cooper & Randall M. Packard (eds). (Berkely: University of California Press, 1997), p.184.
[112] *Ibid*.
[113] Utsa Patniak. *The Republic of Hunger and Other Essays*.(Palam Vihar: Three Essays Collective, 2007), p.13.
[114] *Ibid*., p.14.
[115] Perkins, *Geopolitics and the Green Revolution*. p.260.

were recruited directly from positions there. The RF was thus heavily influenced by cold warriors, such as Nelson Rockefeller, who strove to take every step possible to combat international communism.[116] Yet as a philanthropic foundation the RF was careful to distance itself from any apparent hint of impartiality. In an internal RF memo it was stated that the Foundation should be "pro-democracy without being anti-communist."[117] One way of accomplishing this false impartiality was by continuing the cold war through other means, such as encouraging capitalist friendly science and technology, researched by particular kinds of people. Warren Weaver of the RF's Division of Natural Sciences voiced his concerns over giving grants to non-American biologists, claiming in 1948 that every element of science would be harnessed towards victory "under the conditions of modern total war...food, drugs, and many other things are as essential as are the special weapons designed by physicists and engineers."[118] Excerpts such as these illustrate that the Foundation's "objective" pursuit of science was limited by subjective fears, ideology, and national self interest.

Wallerstein's assertion that the social sciences played a role in regulating capitalist friendly social change is further corroborated by documents from another organization thick with Rockefeller influence, the Council on Foreign Relations (CFR). John Rockefeller III was a member of the CFR's Study Group on US Policy and South East Asian Instability and the proceedings of their meetings reveal that the CFR felt that "the importance of improving the peasant's economic status cannot be overemphasised. His extreme poverty has been a major factor leading to civil war, and lasting stability can hardly be achieved until this problem ameliorated".[119] The "peasant problem" was especially troubling in the largely agrarian nation of India where a neutralist position in the cold war had been adopted.[120] In addition to poor economic conditions in the villages India was thought to have "sought mutual accommodation and co-existence with the communist powers and close

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[116] Colby, Gerard & Dennet, Charolette. *Thy Will be Done: The Conquest of the Amazon, Nelson Rockefeller in the Age of Oil*. (New York, Harper Collin Publishers,1995), p.220.
[117] *Ibid*., p.220.
[118] Jacob Darwin Hamblin ."A Global Contamination Zone: Early Cold War Planning and Environmental Warfare" in *Environmental Histories of the Cold War*. (eds) J.R. McNeill, Corinna Unger. (Cambridge: Cambridge University Press, 2010), p.100.
[119] Council on Foreign Relations, Study Group on US Policy and South East Asia, 1954. Rockefeller Archive. Box 10. Folder 49. p.10.
[120] Council on Foreign Relations, Study Group on US Policy and South East Asia, 1959. Rockefeller Archive. Box 7. Folder 49. p.7.

cooperation with China."[121] Since India "exerts a powerful influence on the attitudes and polices of the South East Asian governments" its tendency towards "neutrality is a real danger to American security...Therefore, United States policy should be devoted to bringing the neutralist states to a militant anti-communist position".[122] However, since military alignment had failed between the US and India it was recommended to "maintain the best possible relations with the neutralists and secondly, to attempt to increase their independent strength".[123] The CFR regarded the social sciences as a kind of soft power which could ensure such "independent" strength was favourably established.

In order to strengthen the stability and "independence" of South East Asian nations such as India, the CFR recommended that, in addition to government direct aid programs, further "sociological data" be collected in the form of "opinion surveys", so that a more intimate knowledge of the peasant grievances could be ascertained.[124] Since the communist cadres seemed so much more in tune with this class's particular grievances, the capitalist social sciences were thought capable of providing a counterweight of insight. However, the developing "countries are suspicious of cultural anthropologists, psychologists, sociologists, etc...The labels 'agricultural economist' and 'Orientalist' seem to avoid the usual antagonism to Western research scholars".[125] The social science work done by Foundation agent Chadbourne Gilpatric to be discussed later, bears a striking resemblance to this kind of activity. Subtle sociological data was needed to gain covert long term influence since direct political pressure could have negative consequences. Furthermore, indirect efforts to "localize permanent aspects of pressure in a symbolic representation at a specific focal point" could be more effective.[126] Such an initiative might work through aid programs enacted at the village level. Specifically, importance was placed on "agricultural modernization schemes because we have to 'buy' votes quickly in some areas and this is the most effective way. In addition such programs may be

[121] *Ibid*.
[122] *Ibid*.
[123] *Ibid*.
[124] *Ibid*., p.4.
[125] *Ibid*.
[126] *Ibid*.

more in line with the aspirations of the villagers themselves".[127] The global agricultural modernization campaign known as the Green Revolution appears ominously reminiscent of such discourse. It was perhaps an effective way of "buying votes" from the new rural bourgeois it helped create, but it is not possible to directly link the comments of the CFR to the actions of the Rockefeller Foundation. However, it should be noted that John III had notable influence within the RF and by the 60's brothers Nelson and David Rockefeller were active members of the CFR and continued where there father left off. CFR recommendations had particular potential for implementation by the adamant cold warrior Nelson, whose influence on RF policy into the 1960's and 70's is well documented.[128]

Revolutionary Fervour: India and the Onset of the Green Revolution

In India the themes of Cold War politics, Malthusianism, normalization of the US agricultural experience, and nationalism coalesced over a period of decades, but it is generally recognized that 1964 marked the year of the Green Revolution's genesis.[129] It was in that year that a new Minister of Agriculture was named and a new approach to agricultural development was embarked upon. The Minister, Chidambara Subramaniam, initiated "a fresh consideration of the assumptions, methods, and techniques as well as the machinery of planning and plan implementation in the field of agriculture" within the Planning Commission.[130] He was soon made aware of recent advancements in seed breeding done by the Rockefeller Foundation at their center in Mexico. The pinnacle of this advancement was the high yielding varieties (HYV) of wheat seed developed by Normal Borlaug. The HYVs, which were a cross between a Japanese dwarf strain and native Mexican strains, won him the Nobel Peace Prize in 1970, but in 1964 they were still largely confined to a few seed breeders' fields

[127] *Ibid*., p.3.
[128] Colby, *Thy Will*. p.191.
[129] T.J. Byres, Ben Crow, and Ho, Mae Wan. *The Green Revolution in India.* (Milton Keynes: The Open University Press, 1983), p. 27.
[130] Frankel, Francine. *India's Green Revolution: Economic Gains and Political Costs. (*Princeton: Princeton University Press, 1971.), p.5.

and test plots in Mexico. It was this year however, that the RF representative in India, Ralph Cummings, brought the HYV technology to the attention of Subramaniam.[131]

Subramaniam's desire to rethink agricultural development in light of recent technological developments was influenced by a debate among officials in charge of orchestrating India's Five Year plans. According to seminal Green Revolution scholar Francine Frankel, this debate originated with the Planning Commission's initial desire for a labour intensive rather than a capital intensive path of rural development.[132] This strategy, codified in the First and Second Year Plans, was based on the goal of reducing social disparities by increasing the capacity of farmers to engage in "intensive cultivation of land by hand"[133] coupled with sweeping land reform and community development projects. Only secondary attention was given to capital intensive inputs and techniques at this point. Paramount priority was assigned to the issue of land reforms, which included the security of tenure, the transfer of ownership rights to tenants, lower rents, and the redistribution of land.[134] However, the legislation passed to this effect was poorly implemented owing to the resiliency of the landed rural elites. Frankel notes that the legislation itself was often watered down at the regional level due to the high representation of land-owning interests in the state legislatures.[135]

The "go slow" approach to land reform which emerged as a result of this class compromise hindered the ability of labour intensive methods of agricultural production to make significant gains.[136] The lagging growth rates in the agricultural sector resulting from a poorly reformed land holding system soon became a factor limiting the country's overall economic advance, particularly in industry.[137] As the planning process for the Third Five Year Plan began, Subramaniam's interest in the HYV technology offered a way out of the agricultural dilemma. Since class interests had stymied

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[131] C Subramaniam. *The New Strategy in Indian Agriculture.* (Vikas Publishing House, New Delhi, 1979), p.22.
[132] Frankel, *Green Revolution*. p.4.
[133] *Ibid*.
[134] *Ibid*.
[135] *Ibid*.
[136] *Ibid*.
[137] *Ibid*., p.5.

land reform, thus preventing labour intensive production methods from succeeding, the capital intensive methods demanded by HYVs could advance production within the unreformed structure.[138]

The Indian government was desperate for any solution to the agriculture question, while poor weather and threats on their borders at the time only aggravated this anxiety. 1965 and 1966 saw consecutive monsoon failures which were some of the worst on record and ensured a drastic reduction in national foodgrain production.[139] To make matters worse, in 1965 war broke out between India and Pakistan, one of India's chief suppliers of wheat. The need for food imports jumped sharply. A five year aid deal with the US saw only half of the aid delivered, and in exchange for increasing the pace of delivery of foodgrains, the Indian government was forced to strike a hard bargain. Among other things, India was forced to give up control over the pricing and distribution of private fertilizer sales. The government was also forced to relinquish its 51% stake in joint ventures in the fertilizer industry.[140] Instances such as this highlight the vulnerability of the Indian economy to foodgrain imports and demonstrate the tangible hindrances low agricultural production placed on such a populous nation.

By November of 1965 the new capital intensive approach was solidified in Subramaniam's New Agricultural Strategy. The strategy was based on the import and propagation of HYVs from Mexico applied intensively in select districts which met favourable prerequisite conditions. Such initial conditions included adequate irrigation infrastructure, dependable average rainfall, and large populations of successful farmers in wheat growing regions. The New Strategy was based on the previous success of the Intensive Agriculture District Program (IADP) initiated by the Ford Foundation in 1961.[141] This program was based on the "package of practices" concept which combined the best testing seed varieties with chemical fertilizer, irrigation, and pesticide, with an extensive agricultural education program. This program was carried out in select districts, two per state, nation-wide, with the majority of funding for extra inputs and staff coming from the Ford

[138] *Ibid*.
[139] Byres. *Green Revolution*. p.27.
[140] *Ibid*.
[141] B. Sivaraman. *Bittersweet: Governance of India in Transition : Memoirs of B. Sivaraman*. (New Delhi: Ashish Publishing House, 1991), p.184.

Foundation.[142] Since the Mexican dwarf wheat had not been developed yet, the package was based largely on labour intensive and traditional practices, augmented with the refined agronomic techniques and selectively bred seeds developed at the Indian agriculture universities.[143]

The IADP pioneered by the Ford Foundation had been successful in a number of districts and the advent of the Mexican HYVs coincided perfectly with a new found political will to opt for capital intensive rural development. Subramaniam relates that such a strategy was not immediately well received by the scientific community. Many career scientists were hesitant about supporting the new technology since it was thought that native varieties should be used instead of wheat from Mexico and Japan so that disease and pest resistance would not be compromised.[144] Opposition groups in the government such as the Communist Party of India contended that the promotion of the HYVs was an "American idea and should therefore be resisted. It was projected as a way of bringing American domination to the field of agriculture."[145] Furthermore, sociologists speculated that the new technology applied in select districts would have the effect of exaggerating income disparity leading to social tension. The sociologists asserted that this was a "dangerous" path for the nation to take since land reform had not been effectively implemented and while large farmers would reap the benefits small farmers would pay the price.[146] Subramaniam responded to such criticisms by asking his dissenters "should industrial development only take place once there is an assurance that everybody would receive a certain level of income?"[147]

Despite the opposition, the Planning Commission had already incorporated many of Subramaniam's ideas into the Third Five Year Plan, and in 1966 Indira Gandhi gave the New Strategy her full support.[148] In the early years of the green revolution, 1967-1968, the Intensified Agricultural District Program was put into effect and diffusion of the new strategy was limited to only the most historically fertile areas of India's grain belt. This led to an uneven process of capital accumulation

[142] *Ibid*., p.184.
[143] *Ibid*., p.272.
[144] Subramaniam, *New Strategy*. p.24.
[145] *Ibid*., p.26.
[146] *Ibid*,. p.24.
[147] *Ibid*., p.27.
[148] *Ibid*., p.27.

favouring well endowed regions, such as Punjab and Uttar Pradesh, and well endowed classes, such as large landowners and money lenders. [149] The RF justified their promotion of the Intensified Agricultural District Program approach in a document entitled "The Technological Basis for Intensified Agriculture", produced in 1969.[150] It lists the assumptions which guided the motivation of the RFs role in the IADP frankly. Five key assumptions were listed by the author: First, there was an urgent need to increase agricultural output because yields were static while the population was growing. Secondly, increases in food production and stabilization of population growth must happen simultaneously. Third, peace was necessary. [151] Fourth, rural populations had to be assisted to increase agricultural production and income levels as well as to "participate in the market economy."[152] The rural population "must contribute to the creation of wealth [and] must increasingly become consumers of products of urban based industry." [153] The final assumption was that the creation of wealth in the countryside was the prerequisite for all other forms of economic and social development.[154] The report concluded that the only way to facilitate this creation of wealth was through the miracles of modern technology applied intensively to agriculture in handpicked districts, to handpicked farmers.

From the start the IADP was a program of "betting on the strong"[155] and it inevitably led to regional and class disparity. This geographical and class bias led to affluent farmers and regions, such as Punjab and Uttar Pradesh, accumulating the lion's share of the new rural wealth, as well as the Third Year Plan agricultural funding. Frankel notes that this would especially be noticed in the dry and rain-fed regions of the country, but also within the areas taking part in the IADP due to small farmers' inability to access capital for investment in the new inputs.[156] Frankel cites a Home Ministry report from 1969 entitled "The Causes and Nature of the Current Agrarian Tension" to illustrate this

[149] Byres. *Green Revolution*. p.30.
[150] Sterling Wortman. "The Technological Basis for Intensified Agriculture, 1969". New Delhi Field Office. Box 94, Folder 619.
[151] India and Pakistan fought a in 1965, and would again in '71.
[152] *Ibid*., p.4.
[153] *Ibid*.
[154] *Ibid*. p.6.
[155] Byres. *Green Revolution*. p.30.
[156] Frankel, *Green Revolution.* p.9.

point. Here she notes that there was an "increase from 19 to 43 reported cases of agrarian conflict in one year (from 1967 to 1968)...and concerned demands for increased agricultural wages, security of tenure, larger crop shares, and most important, redistribution of land."[157] While the causes of the increase were legion, and included the failures of previous land reform attempts, the "proximate" causes "which actually converted latent discontent into open conflict were located in the new agricultural strategy and green revolution." [158]

Much of the discontent was due to the landless labourers desire to share in the gains being reaped by the large land owners who were their employers. While granaries and landlords' pockets were both bursting the toiling classes were denied their share of the new wealth. Furthermore, as landholding concentrated more landless peasants became potentially radicalized agricultural labourers.[159] As early as the summer of 1967 large parties of Marxist-led farm workers laid down their implements and staged country-wide protests over wages. Workers entered landowners' fields and prevented outside labourers from continuing farm operations. Marxist M.L.As rallied workers in Thanjavur, in South India, and *ghearaoed*[160] landlords' homes demanding wage increases in some cases, or to hire only local workers in others.[161] Abductions, beatings, arson, and murders were reported on both sides as landlords began hiring their own security forced to deal with the increasing intrusions of farm workers. One incidence in Thanjavur saw 200 landowners and their goons descend on a camp of striking workers where they set ablaze 25 huts burned to death 43 people, mostly the wives and children of striking workers, as they slept.[162]

The establishment of the Small Farmer Development Agency (SFDA) was part of the Fourth Year Plan and was intended to compensate for the imbalance and radicalization created by the IADP. In India, as in Latin America, development planners thought that modernization campaigns would

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[157] *Ibid*.
[158] *Ibid*,. p.10.
[159] "Agrarian Distress and Land Acquisition" by Utsa Patniak. Monthly Review, 2011. http://mrzine.monthlyreview.org/2011/patnaik130611.html.
[160] Hindu word meaning, to surround.
[161] Frankel. Green Revolution., pp.113-114.
[162] *Ibid*., p.115.

contribute to "social and economic stability" through the creation of a middle class.[163] Small farmers had the potential to fill this rural void, bridging the income gap with the IADP empowered rural bourgeois. This agency's purpose was to extend credit, irrigation, inputs, and technical advice for small farmers.[164] However, while Frankel celebrated the adaptive nature of the Planning Commission, she critiqued the scale on which the program was mounted, suggesting that the small farmer was still viewed as a "residual or marginal" category. [165] In reality, this demographic made up the vast majority of farmers who, as things stood, possessed neither the means nor the incentive to adopt the Green Revolution technology. The Fourth Plan, though responsive to the disparity created under the GR, would continue to champion the rural elites as the primary drivers of rural wealth creation, but it would do so at the nation's potential peril. Frankel explains that:

> the rapid agricultural modernization which began in the late 60's tended to undermine traditional norms of agrarian relationships based on exchange of mutual, if non-comparable, benefits and services that have historically produced a justification for inequalities between the propertied upper and middle castes and the landless low castes...As traditional landowning patrons increase their advantages by striking margins, yet neglect to fulfill their previous function of providing security to client groups, the legitimacy of existing –and growing –disparities is increasingly called into question. The potential impact on rural stability is all the more serious because radical parties openly proclaim their intention of transforming social tension in political conflict.[166]

The radical parties referred to by Frankel were the Communist Party of India (CPI) and the Naxalites. The CPI initiated a nation-wide "agrarian struggle" in the summer of 1970, which involved land grab agitations in Punjab, Uttar Pradesh and a number of Southern states. Simultaneously, Naxalite groups were gaining support in the rice growing regions of the East and South calling for a Maoist revolution using class violence in rural areas.

Similarly, Vandana Shiva recounts the social costs of the GR in the region once touted as the exemplary model of agricultural transformation in India, Punjab. Two decades of the monoculture

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[163] Daniel Faber. *Environment Under Fire: Imperialism and the Ecological Crisis in Central America* (New York: Monthly Review Press, 1993), p. 48.
[164] Frankel, *Green Revolution*. p.194.
[165] *Ibid*.. p.195.
[166] *Ibid*., p.198.

and heavy irrigation practices of the GR package resulted in indebted farmers, depleted and diseased soils, desertification, salination, and pest infestation on unprecedented scales.[167] Violence also became a common feature of the Punjab countryside as over 15,000 inhabitants were killed by the end of 1980's.[168] Shiva notes the religious dimensions to the conflict, but insists that such violence was initiated in the first place by the GRs breakdown of social relations and encouragement of environmental degradation. [169]

Such social tensions were inevitable according to Frankel, who points out that "the old pattern of diffuse, customary relations still pervasive in village economic life cannot stand the test of income maximization. Inevitably, the landed classes are tempted to re-evaluate the obligations of traditional agrarian society in terms of commercial norms".[170] Wolf Ladejinsky noted similar issues relating to changing patterns of social relations due to the GR in comments from a 1972 trip to Punjab for the World Bank. He notes that "economic values are gaining over traditional considerations is observable in the mode of community affairs... and the raise of individualism."[171] He also says that the "narrow base" of the GR has accentuated regional and class differences, with sharecroppers occupying the most vulnerable position.[172] For the first time in India those classes who had the potential to invest were able to reap huge benefits from the new technology. The GR allowed for agricultural investment to take a form different from massive public expenditure on nation-wide projects. Investment could take place at the individual farm level by the producers themselves through the purchase of divisible inputs.[173] The sizable returns on investment in this manner helped landowners default on their customary obligations while embracing commercial norms. Marx's notion of money relations taking the place of traditional relations are illustrated in these commercial norms, such as insisting on cash payments rather than share-cropping for tenancy

[167] Vandana Shiva. *Violence of the Green Revolution*. (Delhi: Research Foundation for Science, Technology and Ecology, 2010), p.191.
[168] *Ibid*., p.190.
[169] *Ibid*,. p.15.
[170] Francine Frankel, & Karl von Vorys. *The Political Challenge of the Green Revolution: Shifting Patterns of Peasant Participation in India and Pakistan*. (Princeton: Princeton University Press, 1972), p.6.
[171] Wolf Ladejinsky. "Agrarian Issues and Programs, Contributions to the World Bank's Annual Reports, May 1972. " Agrarian Reform as Unfinished Business: the Selected Papers of Wolf Ladejinsky. (New York: Oxford University Press, 1977), p.85.
[172] *Ibid*.. p.87.
[173] *Ibid*., p.7.

and cash wages instead of wages in kind were part of a redefinition of rural relations. Frankel insists that "the result is that the green revolution is proving to be a catalyst toward a redefinition of agrarian relations between the dominant landed groups and the landless in adversary terms, based on new notions of opposing economic interests".[174] Dependency theorists have argued that this inequality was structurally imposed by a system designed to further serve the interests of international capital. Here, the macrocosm of the imperial core gaining at the expense of the periphery is mirrored at the village level, centered on the new rural bourgeoisie. Such capital flows were concretized due to the inherent technological bias at the institutional level, both nationally and internationally.[175]

Frankel's observations regarding the effects of capital accumulation were made while the GR was still in full swing and her class analysis, while poignant, has not escalated to the degree warned of in many of her writings. Fears of the "Green Revolution turning Red" [176] never materialized largely because some of the trends of class conflict taking place in the late 60's and early 70's were mediated by the state. Postcolonial scholar Akhil Gupta provides examples of this mediation in his account of the rise of Indian populism. Drawing from the work of Frankel, he contends that "the rise of a class of surplus producing farmers, growing inequalities between and within regions, and the relaxation of ties of patronage created the structural conditions favourable for populist appeals to succeed."[177] Many of the peasant movements to emerge from this period were led by this new affluent rural class who had been the beneficiaries of "the powers of accumulation unleashed by the green revolution."[178] By the early 1980's populist politics continued and showed more support in the Eastern regions of India, such as Andhra Pradesh. There, both the Congress and state Telugu Desham

[174] *Ibid*., p.275.
[175] Rondolf Barker & William Whyte . "Reorienting the Social Sciences" in *Higher Yeilding Human Systems for Agriculture*. (eds) William Whyte and Damon Boynton. (Ithaca: Cornel University Press, 1983), p.275.
[176] Frankel. *Green Revolution*. p.80.
[177] Gupta. *Postcolonial*. p.62.
[178] *Ibid*. p.62

Party attempted to win the allegiance of disaffected rural male labourers "leading to ad hoc populist state welfare interventions."[179]

Indira Gandhi led the populist shift at the national level in her campaign in 1971, at the height of the GRs influence. Espousing policies aimed at the "removal of poverty" she increased emphasis on state planning projects which extended services to marginalized rural inhabitants.[180] While Gupta remains critical of the real impact of her rhetoric, he details a number of concrete welfare institutions to emerge from this populist period. The pilot program for the SFDA was extended to twice the number of districts and 40 projects were added to the agency for Marginal Farmers and Agricultural Labourers. Furthermore, the first indication of ecological specific development was evident in the creation of the Drought-Prone Areas Program. The establishment of such institutions ensured that subaltern class specific agendas would remain an influence for decades to come, while also providing a space for researchers to contribute to new development methodologies. While the implementation of these and other poverty reducing welfare schemes may have not made significant gains, however, this "spirit of compromise" had the net effect that the rural masses' "potential antagonism was neutralized" from catalyzing more severe action.[181]

Ten years after Frankel's analysis government programs directed at poor peasants softened the antagonism between the rural classes initiated by the technologically deterministic and class biased IADP. These aspects of the IADP have been shown to originate in the deeper structural contradictions of capitalist influence and nomothetic reductionism embedded in the production of global knowledge in the natural and the social sciences. In the end the new technology and the New Agricultural Strategy which kick started the GR ensured the further consolidation of rich peasants as a dominant class, particularly in North Western India. This dialectical process increased class tensions and thereby contributed to a "consolidation and heightened self-awareness of the subaltern

[179] T.J, Byres."Rural Labour Relations in India: Persistent Themes, Common Processes and Differential Outcomes" in *The Journal of Peasant Studies*. Vol 26, No 2 and 3, January/April,(1999). p.22.
[180] Gutpa. *Postcolonial*. p.67.
[181] *Ibid*,. p.69.

classes."[182] Not only did the GR's contradictions encourage internal class consciousness among the peasantry, but also heightened the consciousness of outsiders to the conditions of these subalterns. One consequence of this new awareness of class conditions was the effort to develop technology suited to its specific social and ecological needs. The ecological component took shape simultaneously as attention shifted to regions situated in agro-climatic regions which were unable to grow the staple HYVs of wheat and rice.[183] New research agendas emerged as the demand for mediation of class conflict increased. They were drafted to more directly address the needs of small and marginal farmers and in the process embraced a more holistic and systems oriented approach to the family farm. This approach viewed family farms as decision making units and strove to better recognize the interaction between farmer and researcher.[184] The advent of agricultural social science in general and new research methodologies, such as farm systems research in particular, is evidence of this change in approach.

[182] Himmat Singh. *The Green Revolution Reconsidered*: *The Rural World of Contemporary Punjab*. (Delhi: Oxford University Press, 2001), p.81.
[183] Barker. "Reorienting". p.274.
[184] *Ibid*.

Chapter 2 - Vanguard of the Revolution: The Rockefeller Foundation in India

The broader events and themes of the GR having been discussed it is possible to proceed to a more focused examination of the Rockefeller Foundation's influence on technology transfer. First I discuss the history and context of the primary documents on which this section is based. I will then scrutinize several of the most important documents in detail. This section engages sources largely found at the Rockefeller Archives in Tarrytown, New York. This archive contains the most complete collection of Rockefeller family and Rockefeller Foundation materials anywhere in the world and houses the complete records of the Foundation's New Delhi field office.

The New Delhi office was the Foundation's largest base of operations in the southern hemisphere from 1935 until 1973. It administered cooperative programs throughout India and South East Asia in the realms of public health (1935-73), agriculture (1956-73), and the humanities and social sciences (1964-72).[185] The period of operation for the social sciences division is especially interesting as its years fall within the height of the Green Revolution. The creation of this division and its timing relative to the Green Revolution are no accident as this paper will detail further on. The office, which also served as the Foundation's Far East Regional Headquarters, had more staff dedicated to agriculture than to anything else. Rockefeller agricultural operations in India began in 1956 with the creation of the Indian Agricultural Program (IAP) after an invitation was presented to the Foundation by the government of India and a formal document was signed, the "Memorandum of Understanding". The IAP was the fourth in a series of ambitious national programs in agriculture which started with the Mexican program in 1943. Programs in Columbia and Chile followed the success of Mexico in 1950 and 1955 respectively. The stated purpose of the Program was two-fold: to increase cereal crop production through the development of high-yielding seed varieties which would be suitable for India's climate and soil, and secondly, to strengthen graduate education in agriculture.[186] Under the Memorandum of Understanding, the agreement which set the terms of the anticipated technology transfer, the government of India was to provide the required land, facilities,

[185] Valerie Komor."Record Group 6.7, New Delhi Field Office Records, 1935-76". Tarrytown: Rockefeller Foundation Archives, 1994. p.1.
[186] *Ibid*., p.3.

and a budget for local staff, while the RF supplied a permanent staff of resident specialists and contributed large sums of money for equipment and other expenses incurred by field programs. A number of grants were also allocated for certain agricultural institutions and to encourage selected Indian scientists to pursue research in the United States.

The first concrete step taken by the Foundation in the Indian Agriculture Program was to fund a postgraduate school at the Indian Agricultural Research Institute in New Delhi with the authority to award MSc and PhD degrees. This step corresponded to the larger RF philosophy which viewed research and postgraduate training as interrelated activities and gave the RF an institution through which it could project its influence onto the agriculture scene.[187] Reinforcing this program was the establishment of a series of state run agricultural universities and research stations run by the Indian government after 1960. These universities were modeled after the land-grant Universities in the US with the help of RF advisers in that they placed heavy emphasis on the way in which the research done at these facilities was to be transferred to the countryside. The RF remained closely connected to this network of research and training institutions throughout the IAP. In India, just as in America, farmers were intended to be passive recipients for the high technology generated in the laboratory.[188]

The backbone of the IAP was the All India Coordinated Cereal Improvement Projects which represented a new method of agricultural research in India. This program of the IAP involved agricultural universities and research stations which began a series of crop specific projects incorporating for the first time disciplines related to that crop such as agronomy, entomology, pathology, and genetics. It was started in 1957 with projects dedicated to maize, and eventually included sorghum and other millets (1957), wheat (1961), and rice (1965).[189] The Foundation, the universities, research stations, and the Indian Agricultural Research Institute all collaborated on the same projects and often freely shared the fruits of their separate research. Germplasm collection of indigenous varieties of seed were part of each project, with samples of as many varieties, from as

[187] Stakman, E.C. "Report on observations in India, Sept 21-Oct 26, 1957" New Delhi Field Office, Box 27, Folder 202. p.16.
[188] *Ibid*.
[189] Komor. *Field Office Records*. p.9.

many regions as possible, being collected so that they might be incorporated into the breeding component of the projects. This collection was often the first encounter any of the villagers had with university educated agricultural workers and it was one of the first examples of the project of technology transfer actively bringing indigenous knowledge to global knowledge networks.

It was into these cereal improvement projects that the Foundation first began inserting their specialists. Veterans of the Mexico program, men such as E.C. Stakman, future RF president, George Harrar, and 1970 Nobel Peace Prize laureate, Norman Borlaug, joined with Indian scientists to introduce modern technological agriculture to the rural masses of India. It was Borlaug's successful cross-breeding of Japanese dwarf wheat varieties with indigenous Mexican varieties which won a Nobel Prize and ensured the emulation of the Mexican program in India and elsewhere. These individuals were some of the most respected names in post-war agro-science and the centrality of their ideas to the changing nature of the IAP cannot be understated. Documents produced by these individuals such as internal memos, policy recommendations, and reflections reveal a comprehensive strategy and mutually held assumptions about the proper way in which India was modernize her agriculture.

With their specialists in place the All India Coordinated Cereal Improvement Projects provided the Foundation the perfect vehicle to insert and disseminate their dwarf wheat seeds and the package of agricultural practices which accompanied them. For the high-yielding varieties of seeds were only part of the Rockefellers' vision of modern agriculture. The seeds would release their superb yields only when linked to a package of agricultural inputs which included chemical fertilizer, irrigation and often pesticide. It was the dissemination of this high tech, capital intensive, yield enhancing package to every farmer growing wheat, and later rice, which was the intent of the IAP. But it was one thing to develop a new technology, and quite another to ensure that its diffusion was ensured at all levels of rural society. The input package was sold as "scale neutral" by the Foundation and Indian scientists, meaning that every farm, regardless of size would be able to take advantage of

its benefits.[190] However, with small farmers lagging behind drastically in adoption, social scientists were eventually recruited to point out the blockages of technological diffusion and recommend how to remove them.

The final significant development in the IAP was the work of Chadbourne Gilpatric. In 1964, he moved to India as a visiting professor of Philosophy at Delhi University. Gilpatric was recruited by the Foundation directly from the CIA where he worked for the Office of Special Services (OSS) as well as being a former staff officer of the CIA's Board of Economic Warfare, and member of the Council on Foreign Relations.[191] By 1964, he represented the RF's interests in the Humanities and Social Sciences in India. The intention of this veteran Cold Warrior was to strengthen the Humanities and the Social Science instruction at the new agricultural universities and to increase and preserve relevant library and archival holdings. The incorporation of a social scientist into the largely biologically oriented IAP was a unique precedent in Foundation agricultural operations and indeed in much of Indian agriculture. Gilpatric's main contribution however came in the form of a massive socio-economic study of farmers in the state of Uttar Pradesh from 1968 to 1972. Three major publications came from the study and they represent some of the earliest international social science work done in the context of Indian development. Since the publications are based on the data generated from village level studies and surveys, they are also two of the earliest compilations of indigenous knowledge to enter global knowledge networks. The circulation of these documents was extensive after their initial publication as requests for them were registered coming from many major Indian agriculture universities, the Planning Commission of India's five year plans, the Ford Foundation, the State Bank of India, Farmer's Illustrated Monthly, the Fertilizer Association of India and USAID.[192]

With the history of the IAP largely covered it is now possible to scrutinize the documents held by the New Delhi office more closely. E.C. Stakman, mentor and professor of Borlaug, is one of the earliest contributors to the Foundation's policy. He taught Borlaug at the University of Minnesota

[190] Wartman. *Technological Basis*. p.43.
[191] Colby, *Thy Will*. p.221.
[192] "Request List". New Delhi Field Office Collection. Series 2, Box 148, Folder 1080.

and was the man who convinced him to abandon his interest in forestry in favour of agriculture. Stakman handpicked Borlaug and Harrar to head the Mexican program which Stakman had initiated. Stakman was invited to visit the IAP in its first year of operation and he recorded what he saw in two papers from 1957 and 1959. His first impressions of the IAP provide a context to begin analysis of the documents. Regarding India, Stakman noted that the biggest problem in the country at the time was its food supply.[193] India needed to grow more of its own food and import less and for him the problem with realizing any increase in production was the gap between what was known to scientists and what was done with that knowledge on the ground.

A better balance had to be struck between the production of scientific knowledge and its utilization by peasants. He saw this as a structural problem that was true of agriculture in general, but thought it especially so in India where there existed an unprecedentedly large agrarian population coupled with a gargantuan bureaucracy.[194] In Stakman's opinion, the excessive top-down authority exercised by bodies in charge of agricultural development such as the IARI, were obstructing the diffusion of research as well as preventing the development of technology which was relevant to its end-user, since there were no channels of bottom up communication.[195] He noted that some institutions, such as the IARI, held too tightly to the "British tradition" and that they held a "strong inclination...to investigate certain basic phenomena regardless of their practical importance".[196] For instance, while Stakman saw food, and thus cereal crops, as the quintessential priority for a developing India, the majority of university research funds were allocated to pathology in horticulture, rather than the production of wheat, rice or sorghum. His dissatisfaction with the legacy of inadequate research priorities is succinctly described in his comment, "more money and effort to flour and less to flowers."[197] To counter these trends he recommended that the Foundation and the IARI hold regular meetings between their respective directors and that a consistent and open

[193] Stakman, "Report '57". p.8.
[194] *Ibid*., p.5.
[195] *Ibid*.
[196] *Ibid*., p.8. & Stakman, "Report on a Trip to India, Africa, and Europe, Jan 6-June 19th, 1959". New Delhi Field Office, Box 27, Folder 202. p.9.
[197] *Ibid*. p.16.

dialogue take place between the two organizations.[198] Additionally, the kind of research that was taking place at universities and at the postgraduate level had to be made more relevant. To do this Stakman recommended that graduate students combine their research with that of professional scientists along the lines of the US land grant universities. Directing his comments to the IARI Stakman influenced the way in which RF funding was distributed for the postgraduate school at the IARI institute in Pusa, which was now part of New Delhi starting in 1958.[199]

These were some of the foundational links made between the global network of the Rockefeller Foundation and local Indian institutions. The program of germplasm collection serves to illustrate this point. Within ten years of Stakman's comments the relationship between the RF and IARI had become quite close and India's national agricultural institutions took the international stage in search of worthy specimens of plant seed. A 1967 IARI mission to Ethiopia saw some of the first collaboration between the two organizations internationally. Here the director of the IARI, M.S. Swaminathan, perhaps India's most famous agricultural scientist and the so-called "father" of India's Green Revolution, invited RF staff to accompany his team on a seed scouting and exchange mission to Africa.[200] The exchange was to involve samples of India sorghum collected earlier as well as to procure new sources of seed suitable for the arid regions of India. This was not the first instance of local Indian knowledge embodied in plant material traveling abroad but merely one of the more important and collaborative instances. Of its own accord, the RF had been sending Indian sorghum seed samples to Thailand as early as 1964.[201] To highlight the degree of complexity involved, as well as the extent of the internationalization of this knowledge, it is also worth mentioning that the same Ethiopian project also involved exchanges with the director of the Canadian Department of Agricultural Research at the University of Manitoba, Dr. A. Hannah.[202]

The germplasm collection project remains an important example of dialectical technology transfer for a number of reasons. The indirect traditional knowledge embodied in the indigenous

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[198] *Ibid*.
[199] *Ibid*.
[200] Letter from M.S. Swaminathan to Guy Baird, May 5th 1967.
[201] Ralph Cummings, internal memorandum, June 20th 1964. New Delhi Field Office, Box 74, Folder 487.
[202] Swaminathan. Letter. p.1.

seed varieties which entered international seed exchanges in Sudan and Thailand was one example of reciprocal diffusion. Another, more direct example of indigenous knowledge transfer is visible through a closer examination of the practices used to collect the seed in the first place. In a memo entitled, "Procedures for Collection of Millets" produced in 1959 the RF outlined the methods of its first interpersonal field work in India. According to the document, the collection of as many exceptional examples of indigenous varieties of India sorghum was a prerequisite for successful future plant research programs.[203] The collection took place in farmers' fields by traveling to the villages and households in the vast sorghum and wheat growing regions of India. The work was to be coordinated between an RF agent, an Indian botanist and a local district agricultural officer. Permission had to be granted from each cultivator before collection could take place and all samples had to be accompanied with a data sheet, found in appendix 1, filled in with "information provided by local sources".[204] The author notes that accurate records must be kept because "methods of cultivation are important...Special practices or techniques used to minimize attack from pests, eg. early or late sowing to avoid heavy attack from stemborer or birds and other observations should be noted in the space provided"[205] This is the first recorded instance of RF agents actively transferring Western technology and simultaneously making known indigenous practices and techniques in order to incorporate such knowledge into a global system. The more of this kind of indigenous knowledge collected relating to a certain variety the more rapidly researchers at the IARI or the agricultural universities could grow successful test trials for their selective breeding programs. This local knowledge was incorporated into the agronomic departments of the Indian universities and research stations and then relayed back to other villages through extension services. In this way the dialectical exchange of knowledge produced a constantly recycled and increasingly hybridized knowledge system which is difficult to classify as either homogenously global or local.

The draft of the data sheet which accompanied the field agents into the villages further reveals the extent to which indigenous knowledge was sought after by the formal scientific regime.

[203] Kenneth Rachie. "Procedures for Collection of Millets". New Delhi Field Office, Box 74, Folder 485. p.1.
[204] Memorandum from Kenneth Rachie to Ralph Cummings, Nov 12, 1959., IAP. New Delhi Field Office, Box 74, Folder 485. p.3.
[205] *Ibid*. p.6.

This data sheet served as the guide for collection procedures, a measure of scientific accountability to the farmer, as well as set the minimum limits for farmer/researcher interaction. Each crop collected was to be labelled by a number and date which was matched by both the scientific name and the local vernacular name for the crop. It was to be further identified by the "purpose" it was grown for and the standard characteristics of the given variety, such as "high yield, resistant to insects, good grain quality, etc. specify and elaborate."[206] Location was to be recorded down to the village name, and the name of the cultivator. It is interesting to note that the "name of cultivator" is in the "location" section of the document and found nowhere else, leaving the reader with the impression that the identity of the farmer whose fields bore the desired seed was only as relevant as the name of the village in which the fields were found. The impression is that the data sheet was not intended as a means to document the prior informed consent of the seed collecting, or for the purpose of permission granting on behalf of the farmer. Least of all does the placement and context of the space for identification of the farmer allude to the fact that any credit be given to this individual whose family history and traditions may have been responsible for moulding the genetic outcome of a given seed sample. While today such practices would be scrutinized for neglect of prior informed consent requirements and may be accused of biopiracy, or simply genetic appropriation, the serious abuse of later neoliberal intellectual property rights regimes had not yet brought this issue the public's attention.

In addition to the mundane but essential details of average rainfall, elevation, soil type, and growing season, a final section entitled "cultivation methods" is of significance. Included in this section are questions which demand the field agent's observation of manuring and irrigation techniques.[207] The use of "green manuring" is of particular interest, as this indigenous technique incorporated a cover crop into general crop rotation, which could then be turned over to organically increase soil fertility. The specific crop used for this green manure varied from region to region and accordingly so did its effectiveness as an agronomic technique. "Land preparation, time of

[206] "Data Sheet, ICAR Millet-Maize Collection Scheme, Pusa Institute-Botany Division, Delhi." New Delhi Field Office, Box 74, Folder 485.
[207] *Ibid*.

planting/harvest, cultivations or weedings, [and] other practices" make up the remainder of the data sheet's required fields.[208] The inclusion of such fields in the sheet are not proof that they were fully utilized for every ascension, nor that the details recorded for such fields would have been substantive considering the fact that only a single one to three inch line was provided as space for details to be recorded. However, each one of these fields represents the chance for some novel form of indigenous knowledge to enter the formal scientific knowledge network. Any number of unique land preparation techniques may have been made known to the IARI through these data sheets. The questions regarding timing of sowing and harvesting may have led to alterations of standard practice among field trials for specific varieties, and the green manuring techniques may have been similarly adapted based on knowledge which had previously been the privileged stock of one certain locality. The quantitative statistical averages from the accumulated data of thousands of ascensions would have certainly influenced the agronomic techniques which guided future test trials, even if the averages used were only in reference to times of weedings or sowings. It is sufficient to note that such sheets reflect the desire of a formal scientific network to record indigenous technical knowledge related to the germplasm they would steward. In this way did alternative forms of knowledge become slowly and subtly incorporated into the formal networks within India, and through seed exchange programs, internationally as well.

Some of the earliest memos related to germplasm collection reveal that not only was indigenous knowledge related directly to agriculture important, but so to was knowledge relating to peripheral activities such as the preparation of the food grown. One author notes that "methods of preparation and use should be described in detail for each of the different foods prepared from the cereals. The detailed steps or recipe should be recorded according to the exact sequence followed. Variation on cooking method used in other areas should be noted."[209] Here, cultural practices as well as labour practices are documented, extending the scope of the data collection to the social realm. The focus on agriculturally peripheral activities such as food preparation hint at some nuance in the

[208] *Ibid*.
[209] Rachie. "Collection". p.6.

formal research agenda since such data could help identify more marketable varieties or traits within a certain variety which were desirable to the end user and insight into those traits which would have influenced the genetic composition at the time of collection. The exact reason for the memo requesting such data is unknown, however, as it does not reappear in subsequent documents.

Reinforcing the link between germplasm collection and indigenous knowledge, the same author continues to insist to field agents that "general info on cultural practices, soil type, important pests...should be recorded. More detailed information on climate cultural practices and use are recorded...on the crop growing card."[210] Since such detailed accounts were required for each of the thousands of seed varieties eventually collected by the Foundation they represent one of most extensive and earliest examples of the incorporation of indigenous knowledge into global scientific frameworks. The data set they represent is responsible for partially guiding every selective breeding trial done at the IARI and every new variety and agronomic technique to emerge from the institution. The collection of indigenous knowledge contained on the germplasm cards is one data set which guided the research done in Delhi, but the seeds themselves may be the most important and often overlooked one. The germplasm collection was the first part of a strategy to develop an effective breeding program which could produce and reproduce an improved variety of seed to all of India. The new varieties of seeds which later emerged from the IARI research stations and were sent back to the farmers will be discussed in this next section. As the dawn of the Green Revolution brightened, the traditional knowledge contained in countless seeds slowly worked its way through the machinery of the formal scientific network, becoming ever more influenced by the standardized regime of laboratory testing.

In 1963, M.S. Swaminathan personally invited Norman Borlaug to visit the IARI after being impressed by a series of successful hybrid wheat trials Borlaug recently conducted in Mexico.[211] Borlaug was asked to act as a consultant regarding the possibility of conducting similar trials in India with the intention of rapid propagation and distribution of the new seed. Borlaug concluded that the

[210] *Ibid*.
[211] R. Anderson. "The Progress of the India Coordinated Wheat Program, February, 12, 1969" New Delhi Field Office, Box 55, Folder 378. p.7.

climate and soil conditions were adequate for the high yielding varieties of wheat developed by him and RF in Mexico. The new seeds would of course have to be accompanied by the same package of inputs as in Mexico, namely chemical fertilizer, irrigation, and pesticide. In addition to consultation on climatic and soil conditions Borlaug lent his expertise to consultation on the structure and attitudes of the research done by the IARI and the All India Coordinated Wheat Program. In his official report of the visit Borlaug comments that on the vital need make the new technology as appealing as possible to increase its adoption. Wheat field demonstrations conducted by agricultural extension agents were to be made "as spectacular as possible"[212] for if extension of the new technology in wheat failed then no other crop could hope to succeed. Swaminathan too advocated for advances in extension methods and was one of the first to encourage the inclusion of women in a "two way dialogue between extension personnel and farmer."[213] Furthermore, for Borlaug those in charge of the HYVs such as the plant breeders and agronomists had to be "forwarders, catalysts and visionaries", while "traditionalism and conservatism should be downgraded, for they are poor foundations upon which to build a revolution in agricultural production". [214] A revolution in production is exactly what RF had in mind as Borlaug approved the transfer of suitable varieties of his Mexican wheat to India. However, this historic transfer of technology was guided by a number of assumptions which would marginalize the role of other forms of technology and knowledge. Conservatism and traditionalism were words which were not only applied to scientists, but also to those farmers who were not "progressive" enough to buy into the HYV package. This revolution required farmers and scientists alike to embrace the new top down approach to knowledge production as well as its capital intensive principals unless they wanted to be treated as stagnant, or worse, as counterrevolutionary.

[212] Norman Borlaug, "A Brief Report on Progress Being Made by the Indian Coordinated Wheat Improvement Project, April 12th, 1966". New Delhi Field Office, Box 55, Folder 378. p.7.
[213] Swaminathan, M.S. *Sustainable Agriculture: Towards Food Security*. Delhi: Konark Publishers, 1996. p.167
[214] Borlaug, "Report", pp.13-15.

Social Science and the Revolution

The kind of village level knowledge which concerned the Foundation at this stage centered around farmers' relationship to the new technology, with an emphasis on how they could be encouraged to adopt it more readily. This is illustrated by the social science reports complied under the leadership of Chadbourne Gilpatric. The methodology used to extract farmer perceptions was novel and reveals a great deal about the assumptions which guided the diffusion of indigenous knowledge from the early GR. The three reports represent the first major effort by any international organization to document the attitudes, behaviours and opinions of India's rural population for the purpose of agricultural development. This was also a joint effort between the RF and Uttar Pradesh Agricultural University. Gilpatric was the principal adviser for the project, as well as the principal author of the final report. Authors are not listed for the first two and they appear as publications of the Uttar Pradesh Agricultural University. Gilpatric's "research problem", as described in the appendix, was concerned with the coordination of data collection and processing. [215]Six other Foundation staff worked on the project, two of whom worked as research officers and doctors of sociology. One of them was dedicated to issues of tenure conditions and infrastructural institutions and two, surprisingly enough for the late '60's, were computer programmers.[216] The reason for this seemingly disproportionate allocation of resources will be clearer after the heavy statistical data of the third report is discussed.

The earliest report entitled "Changing Agriculture and Rural Life in a Region of North India: A Study of Progressive Farmers in North-West Uttar Pradesh During 1967/68", focused on the primary producers of wealth during the Green Revolution, large land holders and those with enough capital to invest in the package of inputs which accompanied the HYV seeds. Here, a farmer was deemed "progressive" if at least 30% of his sown land was irrigated, 20% was sown with HYV seed, 20% was under chemical fertilizer, if they had private irrigation facilities such as a tubewell or pumpset, or

[215] Gilpatric, Chadbourne. *Problems and Prospects of Small Farmers in Uttar Pradesh in 1969-70*. U. P, Agricultural University, Pantnagar. New Delhi Field Office. Box 149, Folder 1090. appendix p.1.
[216] *Ibid*.

owned machinery.[217] These criteria ensured that very few "small" farmers were also considered "progressive" farmers. The vast majority of such progressive farmers held over 30 acres. [218]

The report detailed six specific kinds of data regarding progressive rural inhabitants. First was their use of physical inputs, meaning what existed on the farm in terms of capital, both in the form of fixed capital such as irrigation systems and storage facilities, as well as yearly expenditure on fertiliser, seeds and pesticide. They also measured agricultural performance, insofar as they recorded how intensively the land was being used, and what access they had to modern agronomic techniques, such as double cropping. The third, "economic rationality", is far more difficult to measure than the first two. Another round of surveys sought the inhabitants' opinions and behaviours regarding risk and investment. What kinds of investments were the cultivators likely to make and what was done with their surplus income were two of the big themes. Consumption patterns in general were also taken into account. Examples of such consumption statistics included how many bikes were owned, how many cars, draught animals, radios, refrigerators, washing machines, luxury food items, and so on. Fourth, the report detailed the rates of adoption of the HYV package. Fifth was termed "background advantage", and chronicled the caste, education, social status, and experience in agriculture.[219] The final quality catalogued was an odd inclusion and poorly expanded on by the report. The attribute "moral character", consisted of documenting the cultivators work ethic, honesty, fairness and "agricultural activity that harmonizes new ways and values with long standing convictions", the meaning of which is never fully articulated in the report but comes across as a search for ways of negotiating the tension generated in the process of attempting to introduce modern capitalist production techniques into a tradition-bound social milieu. This was part of a search for effective community leaders who could balance traditional cultural values with the new production methods. Social scientists from India, specifically the Indian Institute of

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[217] *Changing Agriculture and Rural Life in a Region of Northern India, 1968.* U. P, Agricultural University, Pantnagar. New Delhi Field Office. Box 149, Folder 1090. p.32.
[218] *Ibid*.
[219] *Ibid*,. p.19.

Management, and the RF wanted to know which attributes progressives displayed which could be used to enhance the social mediation and broader acceptance of the new technology.[220]

The report's conclusions focused on ways of increasing the adoption rates of the medium sized and small progressive farmers, since the large ones rarely needed convincing. It spent many pages on the investment and credit patterns of these rural bourgeois elite, who were the largest employers of landless labourers, renters of land, and suppliers of credit. The progressives were also in the habit of using the ancient system of sharecropping to collect rent or pay for their own land leases. An interesting note from the report was that in the agricultural productivity section it was found that yields per acre were not as high on the progressive farms as they were on the small farms.[221] However, the overall productivity was 31% higher on progressive farms resulting in huge income gains in these households, but this was because they could compensate for poor quality of per acre output when they had incomparably more acres to sow.

The next report was entitled "Changing Agriculture in Two Regions of Uttar Pradesh in 1969/1970" and begins by discussing the diffusion of HYVs among various levels of landholders. Rates of adoption were unusually high in these regions relative to the rest of India since as much as 50% of small landholders were reported adopters. Here, "small" meant a landholder who held under 7.5 acres of land. Using these criteria the RF determined that 9 million of Uttar Pradesh's small holding rural families grew some HYV wheat.[222] The adoption rates rose exponentially in proportion to the amount of land held, as rates reached 90% among large farmers. Reasons for such high adoption rates were in part credited to the high percentage of "progressive" large land holders also adopting. Emulation was seen as a key factor and reinforced the desire to collect data on this segment. The report concluded that small cultivators often try to emulate the assets and practices of the larger cultivators, since these individuals are often men of high standing in the community. The RF wanted to increase this emulation since there was no better advertising than then overflowing

[220] Letter from D.K. Desai to Chadbourne Gilpatric, March 30, 1968. New Delhi Field Office, Box 148, Folder 1079.
[221] *Changing Agriculture*, p. 139.
[222] *Changing Agriculture in Two Regions of Uttar Pradesh, 1969-70*, U. P, Agricultural University, Pantnagar. New Delhi Field Office. Box 149, Folder 1090. p.13.

granaries of the large holders. However, it was noted that this emulation was not always in the small farmer's best interest. Despite the commonly touted line that the Green Revolution was based on "scale neutral" technology, the report admits that emulation takes place "even though inputs at one size level may not be economically advantageous for smaller areas. It might be more rewarding for cultivators to consider better the agricultural performance constraints of their own size range of holding. Such superior performances by leading cultivators indicate the potentials as well as the limits of agricultural productivity within a given region for various farm sizes."[223] Despite such findings the myth was continually propagated that the new technology was unbiased in its preference of farm size. However, the yields were increasing dramatically among large land holders who were able to effectively use the new inputs and this translated into increased income. Class stratification inevitably followed as the large holders put their new abundance of capital to work and the report dedicated the majority of its remaining chapters to detailing this phenomenon.

Several factors were cited for the dramatic wealth accumulation which was taking place in the countryside. The data which is presented in this section reflects a different kind of indigenous knowledge than previously discussed. The Gilpatric reports mark a shift in the focus of valuable indigenous knowledge from basic agronomic and cultural techniques, and that knowledge accumulated in traditional crops' genetic codes, to a knowledge pertaining to socioeconomic conditions. Among the information gathered from the farmers was the fact that small farmers received much less income for the same crop at the market place then did their larger counterparts.[224] Poor storage and transportation capacity ensured that even when increased yields were realized the small holder had no means of realizing a proportional increase in income, since he still had to sell his harvest at inopportune times. The small holder was further hindered by "inadequate distribution of information regarding crop prices in alternative and accessible market centers" [225] Such limited options regarding the marketing of produce ensured that even if small holders were able to garner some advantage in using the HYVs and package of inputs, they would be

[223] *Ibid*., p.14.
[224] *Ibid*., p.15.
[225] *Ibid*.

subject to an outdated storage, transport, and marketing system which considerably decreased their advantage relative to the larger holders who had the capital navigate such obstacles.

Credit emerges from the report as one example of how this increase in capital led to a cumulative advantage. The report documented farmers' perceptions regarding the dynamics of financial capital and the tenure of land. While credit was still used more for weddings than agricultural investment, the report noted that " it appear that by far the largest proportion of agricultural credit is supplied by individuals, not by institutional sources such as banks, and cooperative-societies. As farm income increases, many more cultivators are themselves lending money, especially those with larger holdings"[226] Such quotes point to the fact that the Green Revolution technology led to the entrenchment of class position among large land holders by reinforcing their role as money lenders, employers, and landlords. The Uttar Pradeshi farmers surveyed for the report indicated that many of those who were not large land holders were often not holders at all, but were rather sharecroppers on the land they tilled. This semi-feudal system of land holding was not thoroughly discussed in the report, but Gilpatric noted that further study of tenural arrangements and sharecropping is consistent with the main aim of RF research, along with further study of small and very small farmers. [227] One sixth of the RF working with Gilpatric was dedicated to the task of further examining land tenure.[228]

The final report, "Problems and Prospects of Small Farmers in Two Regions of UP in 1969/1970", is unique in that Gilpatric served as its principal author.[229] This report went a step further than the previous two in a number of directions including its use of quantitative data and statistical analysis. The last twenty eight pages of the repost were filled with twenty three graphs and charts numerically chronicling the lives of the 300 small farmers which were surveyed for the report.[230] Two graphs listed such items as farmer age, caste, years in his village, educational level,

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[226] *Ibid*., p.17.
[227] *Ibid*. p.19.
[228] Gilpatric, Chadbourne. *Problems and Prospects of Small Farmers in Uttar Pradesh in 1969-70*. U. P, Agricultural University, Pantnagar. New Delhi Field Office. Box 149, Folder 1090. Appendix p.1.
[229] *Ibid*., preface.
[230] *Ibid*., acknowledgements.

land tenure arrangements, organizational membership, and family size. These graphs revealed that none of the farmers questioned were women. It must therefore be noted that because of women's central role in farming the exclusion of their input from the Gilpatric reports illustrates one crucial instance of how certain unstated assumptions ensured an uneven process of indigenous knowledge diffusion. This gender bias was inherent in the report's methodology as no mention of it was made in the initial questionnaires.[231] This would be a recurring theme in village level research during this period and would take many more years of the kind of exclusive development espoused by Green Revolution policies before alternative development strategies became popularized. This subject will be discussed further in the post-revolution period of this study, but for now it is sufficient to point to the lack of a socially inclusive research methodology regarding gender in the Gilpatric reports and the absence of a female voice in the local knowledge they contain.

The remaining graphs were compiled with vast amounts of numerical data reflecting income levels, consumption patterns, capital assets, expenditure, credit usage, HYV usage, market operations for crops (referring to who bought the farmers produce, at what price, the amount sold, the amount paid as market fees, percentage of sale as a percentage of total output, and so on). For this the Institute of Agriculture Research in Delhi was thanked by the report for the use of their computer and "mechanical tabulation facilities".[232] It was for this novel purpose that two of the six Foundation staff working with Gilpatric were computer programmers. This allocation of both staff and space in the report is indicative of the prevailing influence of quantifiable, "objective", non-interpretive sociological data.

The report classified small farms as those which possessed no more than 7.5 acres and no less than 2.5. It was a comparative study contrasting two regions, Buadan and Tarai, in Uttar Pradesh, a state which contained 4 million of India's 18 million small farmers in 1971.[233] Roughly one in four of those millions were sharecroppers, with one quarter of that number being utilisers of

[231] "Attitudes Questionnaire" Box 149, Folder 1087.
[232] *Ibid*., acknowledgements.
[233] *Ibid*., p.1.

agricultural credit and HYV seeds.[234] 300 farmers were chosen at random from a census of 2000 farmers of the desired holding size within 16 village clusters in the two regions. Villages were selected based on closeness to "mean conditions" across the state, referring to rainfall averages, severe weather and so on.[235] Institutional sources such as banks, cooperatives, Block officials, railways, village leaders, and *Panchayat*[236] members, were used for the statistical data, in addition to the series of surveys conducted at the ground level with the small farmers themselves.[237] The two regions chosen for the comparison varied in a number of ways which lent context to the problems each region faced. In Baudan farmers were recently settled, had little to no irrigation, poorly established banks and cooperative societies, and maintained more "traditional" and "locally" oriented outlooks.[238] Conversely, Tarai boasted well established agricultural infrastructure including tubewells, canals, irrigation, and numerous institutions. The Tarai were longer established in the region and were more "cosmopolitan and modern" generally. Contextually, the comparison allowed for an exploration of the limits of technological adoption based on prior material and cultural advantage.

The central premise behind the report was to measure the "viability" of certain farms. For this purpose viability was divided into four sub categories: non-viable, potentially viable, viable, and highly viable. Gilpatric defines viability as "the ability to support ones family at the standard cost of living for a region with adequate income and production from his farm."[239] The source and extent of net income then was the measure of viability, as one could not participate in the survey if one received the majority of their income from off-farm sources. The author justifies his statistical approach claiming that "the central concept of this small farmer study is their viability differentiated into levels of net income. A viability level scheme is applied mainly to indentify the main features of small farmers who are potentially viable...One hypothesis is that level of viability is closely associated

[234] *Ibid*.
[235] *Ibid*,.p.3.
[236] Hindi term referring to a village or town council.
[237] *Ibid*.
[238] *Ibid*., p.4.
[239] *Ibid*,. p.6.

with levels of new farming technology, productivity, and sale of produce."[240] The use of statistics therefore reduced the viability of farmers' livelihoods into a set of manageable and analysable numbers, which could then be tested against statistics of adoption rates. Such research methods demonstrate the contradictions of scientific reductionism mentioned particularly by Lewontin earlier. Here, the quantitative statistical data was used to provide trends within a supposedly closed system of variables which could not have taken into account the myriad of qualitative factors influencing their outcome.[241]

Despite its limitations, the final report does shift attention away from the large progressive farmers to focus on small holders. Gilpatric notes that "in the last few years attention to their problems has been intensified in action programmes as well as in diagnoses. One cause of this was the widespread view that the 'new agricultural strategy' adopted by the government of India in 1966, and more generally the new technology in agriculture, have had the effect of making larger farmers richer and smaller famers poorer. In current concern with unemployment and poverty on a national scale, small farmers inevitably represent a large crucial sector"[242] This quotation remains a rare admission of the rural tensions being created by the new technology. The data allowed for concrete recognition by Foundation officials of the growing income disparity based on size of holding. Such data would not affect the overall implementation of the New Agricultural Strategy, but it did have the effect of bringing increased social science research to this segment of the population. In this way, rural class stratification had the effect of increasing developmental resources for the subaltern rural classes and accordingly increased diffusion of the knowledge which they produced. This level of inclusion is novel in the Rockefeller Foundation's documents, and thus represents a shift in focus of the IAP. It marks the conclusion of a progression within the reports which began with a focus on "progressives", in 1967 and ends with a focus on village level knowledge concerning marginal segments of the rural population in 1970.

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[240] *Ibid*,. p.7.
[241] Lewontin, "Dialectics", p.51.
[242] Gilpatric, *Problems*. p.1.

The peer reviews which preceded this and the earlier reports' publication were critical of the proposed methodology. Apparently, he had sent a draft of the methodology to a leading Indian social scientist working at the prestigious Indian Institute of Management (IIM).[243] The 1968 letter replying to Gilpatric's draft offered a mild critique of the proposed approach for a number of reasons. First, it was ambiguous in its categorizations of farmers. Categories based on income and inputs were seen as too vague. Second it was felt that more attention could be paid to relationship between "progressive" farmers and small farmers, especially regarding how the former could serve as "opinion leaders" which motivated the "decision making of the rest of the community". [244] The letter, while critical, is mostly congratulatory and recognizes the potential for such studies to enhance the on-going social science work being carried out at the Institute relating to fertilizer marketing. Future social science collaboration between the Indian Institute of Management and the RF was planned. During his PhD years at the IIM Anil Gupta would later build on this work, recalling Desai as "a pioneer, very methodical...a great institution builder", even though he may have been "a bit conservative".[245]

Despite such criticisms, the methodological centrality of net income was not a mere oversight on Gilpatric's behalf, but represents a priority consistent with the precepts of technological agriculture and post-war development strategies in general. This is illustrated in a number of ways throughout the report but the chapter entitled "Consumption" is a striking case in point and worth quoting at length:

> One benefit often overlooked is that consumption and cash demand can and often does operate as an incentive to better agricultural practices. The more his family spends and wants for cash consumption expense, the more income is required by the farmer...His objective is to increase his disposable income and in many situations this motivation , when strong and directly reinforced by family expectation, results in harder agricultural work, more efficiency in cultivation, higher productivity, and sharper attention to marketing problems. Without this insistent and strong incentive, many small farmers may continue to operate with some slackness and well below feasible levels of output and income. [246]

[243] Desai, Letter.
[244] *Ibid*.
[245] Interview with Anil Gupta March 12, 2011.
[246] Gilpatric. *Problems*. p.83.

This comment was preceded by an analysis of statistics of consumption of nonessential items as well as agricultural inputs. The source of credit used to pay for these purchases was also noted.[247] Weddings were the number one expense reported in both regions with more than twice as much credit being borrowed for them as for lifetimes of investment in agriculture. Again the study found that this credit was increasingly supplied by the large holders and at exploitative interest rates compared to the credit institutions. The study concluded that borrowing rates were low for agricultural investment because most small farmers were already in some kind of debt and feared going deeper, or planned future debt, as the wedding of children were always in the backs of parents' minds.[248] However, as exciting as the possibility of increased rural demand for consumption of non-essential items was for decreasing the "slackness" of small farmers, it also raised the potential for decreased consumption of agricultural inputs. A balance was clearly desired since spending limited cash resources on non-essential items meant spending less on pesticides, irrigation, fertilizer, and seeds.[249]

The section which follows shifts focus from data relating to non-essential consumption to small farmer investment patterns. The data reveals that the most common type of small farmer investment came from loans used for purchasing bullock-drawn equipment and implements. The animals themselves were the next largest reason for loans, followed by farm buildings including irrigation. The report noted that there was little investment in processing equipment for farm produce, which was reflected in a lack of diversity in small farm business.[250] Here the report noted the important fact that private lenders, such as landlords, were virtually absent from loans made for agricultural improvement. While the previous reports noted the prominence of private credit sources regarding family consumption patterns, this final data set showed that "the traditional money lender no longer has any role in agricultural credit".[251] Nevertheless, indebtedness was still

[247] *Ibid*., p.80.
[248] *Ibid*,. p.120.
[249] *Ibid*., p.84.
[250] *Ibid*., p.84.
[251] *Ibid*., p.112.

"chronic" among small farmers and it had the tendency of being a "cumulative" problem.[252] This section of the report was compiled with data provided by the rural banks, cooperatives, and a series of surveys conducted among the selected local farmers. In contrast to the quantitative data provided by institutions such as the rural banks, the qualitative data contained in responses given by farmers regarding credit needs "pose difficulties in interpretation...It remains unclear whether the modest needs stated reflect practical needs based on experience and know-how or rather expectation of what credit they might probably obtain from such sources as they know about, and unwillingness to increase their indebtedness."[253] The quote is important because it is the only instance in the report where doubt is cast by the author on the data. Here, Gilpatric admits a rare chink in his nomothetic armour when examples of the complexity of farmer decision making processes arose. Gathering information related to the sensitive issue of credit and debt is not without its problems in rural communities. Alternative social science methodologies to be discussed later will serve to illustrate some of the various problems associated with this task. For now it is sufficient to note that income and debt levels are not always subjects which are willingly or openly discussed with strangers. There is no indication that any attempt was made to build rapport with the farmers which may have led to a more open divulgence of motives and decision-making rationale. This methodological oversight may have been partially responsible for the difficulty of interpreting data from such sensitive subjects, making it quite possible that farmers were just not willing to reveal the complexities of their financial motivations to a novice outside researcher. Instances such as these, where oversight of the human element led to incomplete data collection, contributed to the need for alternative research paradigms.

The Rockefeller archives contained a copy of the survey used in the credit section of the report and it is worth briefly exploring to further understand the exact framework which guided the personal interaction between the village level workers and Uttar Pradeshi small farmers. The survey, an excerpt of which can be found in appendix 2, begins by diplomatically enquiring, "Do you have

[252] *Ibid*., p.113.
[253] *Ibid*., p.115.

sufficient funds for farming and family living?"[254]. A small line accompanied each successive statement for the researcher to note either A for agree or D for disagree. This dichotomous data framework serves to further illustrate the limitations of the diffusion of indigenous knowledge. This is not to say that such statement/response sections are not valid information gathering techniques, as they are still used in modern research, but rather to note that not all the local opinions and data gathered represented local epistemology or the nuanced meanings of local vernacular. They instead reflect Western phrasing, organization, and concepts, which would have to be translated into Hindi or into local village languages. The participant would then be able to only respond to in one of two ways. Indigenous knowledge from the GR period then often return to research networks as a muddled amalgam of local experience stripped of its nuance and reduced to the questionnaire's formal scientific language.

The survey indicated that small farmers sought first to make investments using their own capital, usually investments which showed returns over the "medium term". [255] In 1969, small farmers from Uttar Pradesh appeared to "attach far greater importance to earning cash over borrowing it. Marketing and production...assume precedence well above credit."[256] The report however, spends little more time with such qualitative credit perceptions and focuses the majority of its pages detailing statistics of credit usage regarding Green Revolution inputs. It is noted that among those who borrowed some money for agricultural investment 86% were already applying for HYV seeds and 62% for chemical fertilizer.[257] Of the 86% who were using the HYV seeds however, only three in ten received good yields and increased net income and consumption. The report explains the failure of the new technology on many of the small farms by noting that often too little area was sown, less than 0.7 acres in many cases. [258] This is the second instance where ground level data led researchers to point out that farm size had a direct impact on the production potential of the new technology. It is indicative of the difference between local practice and formal scientific knowledge

[254] "Attitudes".
[255] Gilpatric, *Problems*. p.117.
[256] *Ibid*.
[257] *Ibid*., p.116.
[258] *Ibid*., p.153.

insofar as the introduction of the HYV into a specific locality, far removed from the pampered plots at the IARI institute in Delhi, displayed results which contradicted the official public relations campaign of the Green Revolutionaries. Since no changes were made to adapt the technology to small farmers based on this data, this stands as a perfect example of how the scientific method was contradicted by reductionist science at the behest of class interests.

Undeterred by such results the chapter's conclusion remarks that the HYV package could remain an important factor in transforming the viability of small farmers in a short period of time if certain corrections were made. Not only would know-how have to be increased regarding the proper use of inputs, but also critical investment had to be made in infrastructure such as irrigation, especially in the region of Tarai. Without adequate irrigation during the dry *rabi* the HYV inputs would not perform and were not worth the investment.[259] Although the HYV system was prevalent in the chapters relating to investment and consumption, they do not occupy a disproportionate amount of the report's pages relative to other crops. The chapters contained an equal if not greater amount of data relating to traditional crop varieties, however, such varieties were noticeably absent in the report's conclusions and recommendations.

The report ends by summarizing the major problems it saw hindering the viability of small farms. The two major problems were marketing and "know-how".[260] Marketing is regarded as the more urgent of the two since it directly determines a farmer's income, as well as the incentive level for improvement of production. Problems in the marketing of produce were centered on the need to sell harvests immediately following reaping when supply was at its highest and prices lowest. Also, small farmers were forced to sell to buyers within their own village and were thus extremely limited in terms of price options. Furthermore, it was determined that small farmers "found themselves on the bottom rung of the trading ladder and price scale" with prices averaging 15% lower for the same crop than that of large farmers.[261] This trend was not expected to diminish as "continued rise in

[259] *Ibid*., p.160.
[260] *Ibid*., p.174.
[261] *Ibid*,. p.172.

production ...especially on larger farms will not ease and may worsen small farms competitive disadvantage in selling prices."[262]

The secondary problem of know-how is more revealing in regards to the interaction between knowledge systems. Know-how related to the need of small farmers to have access to "efficient practices in improved production technology...Government extension services that could, if reformed, provide technical guidance are now notoriously weak, especially for small farmers." [263] It was not merely enough for the farmer to purchase the HYV inputs since this new technology differed in many ways from traditional agriculture. The complexity of the modern techniques which accompanied them could be as much a hindrance to a successful crop as weather or farm size. Generations of traditional farming practices could hardly be expected to be shed over night, especially since, as the report notes, the extension wing of the agriculture field was "notoriously weak".[264] "Know-what" was a subheading of this section and related problems not of practice but of strategy. Farmers needed more education in such questions as, "what should be the business of his farm?" and, "what major crops should one select for cultivation?"[265] The "correct" answers to these questions would help farmers minimize risk.[266] This is an excellent example of a key difference between formal scientific thinking and informal science. While local conditions dictated that the farmer would grow multiple crops from local varieties with low cost, on-farm inputs in order to minimize risk, the Foundation and UPAU were convinced that monocropping accompanied by heavy investment and expenditure on external inputs would decrease the risk level of a given small farm. Here, Western capitalist experience guided ideological assumptions about the role of technology and credit in agriculture while masquerading as scientific fact, objectively claiming what behaviours would reduce risk. The infiltration of such biases illustrates the dangers and folly of social science positivism, especially when one considers the relation between debt and the rural suicide rate in India over the past two decades. Less than ten years later however, the factual nature of such claims

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[262] *Ibid*., p.178.
[263] *Ibid*., p.174.
[264] *Ibid*.
[265] *Ibid*.
[266] *Ibid*.

would be questioned and less reductionist science methods would reveal the complex and rational risk calculation used by Indian farmers.

The work done by International Crops Research Institute for the Semi-Arid Tropics in Southern India will serve to illustrate this point later on, but for now it is worth returning to an earlier section of the report which shows that the Rockefeller Foundation was not completely uncritical of India's formal scientific regime. The report notes that in neither Uttar Pradesh "or elsewhere in India, has agricultural research found out and demonstrated what particular types of crops and appropriate seed varieties would probably result in optimal yields and net crop income for small farmers within their existing agricultural conditions."[267] This critical statement shows that a certain nuance did exist within the reports pages which did not single out lack of HYV dissemination for the lack of increased production on small farms. Here, a hypocritical shot is taken at the formal research institution for its inability to consider the local conditions of farmers who did not all grow wheat or rice. Gilpatric commented that options which promote on-farm diversification had not been encouraged by any agency. He used the example of the inattention given to the dairying industry, which had been found to make up a large portion of the local economy, but had no formal research programs in the agricultural universities to support or improve its practice.[268] The present approach represented a "trickle down view, namely what grows best on experimental stations and large farms will do as well on small farms".[269] While this trickle-down effect occasionally worked with the HYV package in those areas with irrigation and adequate extension services, by and large the report concluded that most small farmers were a long way off from enjoying such ideal conditions. It recommended that the Indian agricultural universities further investigate a more diverse range of crops such as pulses, oilseeds, fruit trees, and vegetables.[270] This is a primary example of how increased access to local knowledge impacted the assessment of formal scientific institutions and guided policy recommendations. Local knowledge collected from the villages had thus revealed the

[267] *Ibid*., p.42.
[268] *Ibid*., p.175.
[269] *Ibid*.
[270] *Ibid*.

underexplored diversity of Indian farms as well as exposed the reductionist approach so far taken by the formal science network within India.

Despite brief instances of recognition of the need to adapt research to local circumstances as described above the general attitude regarding local and traditional knowledge was less nuanced. The following passage from the report serves to illustrate this point as it notes that "small farmers continue to lack, or fail to apply, the relevant technological knowledge and production know-how to achieve satisfactory agricultural output. This in part results from deficiencies in extension services, but also reflects the survival of outmoded cultivation practices among small farmers, and their initial incompetence in applying unfamiliar elements of the new technology in agriculture".[271] Such sentiments are echoed in the "know-how" section of the problem review mentioned earlier. Village work ethic was criticised in the report which stated that "rural culture and its traditional slow pace is tolerant of lack of diligence."[272] Poor diligence was exacerbated by land which was too small for family size. In a Malthusian reminder, the report observed that "there is significant and ominous growth in farm family size and in rural population".[273] Increased family planning, a specialty of the RF, was recommended to reduce this. Lack of collective organizations and combined action towards common aims were the final problems associated with lack of know-how. Included in this was farmer to farmer extension. For this the report recommended the enlistment of highly viable farmers to increase the amount of horizontal emulation taking place at the village level. It was hoped that the "less skilled" farmers would accept the advice of fellow farmers more readily then they would the advice of urban educated extension agents. All of the individuals associated with extension were to emphasize the selection of crops based on "seed varieties and associated inputs with reference to high yielding and expected market returns".[274] One local practice recorded in Budaun demonstrated how two famers would combine their individual bullocks to make a pair to reduce the burden borne by the beasts. For Gilpatric this simple example of local cooperation served as a parable for effective local level cooperation.

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[271] *Ibid*., p.42.
[272] *Ibid*,. p.177.
[273] *Ibid*,. p.178.
[274] *Ibid*., p.183.

Three main developmental action programmes were recommended in the report's conclusion. First, was to increase the intensity of land use in cultivation. This was to be done by multiple cropping or double cropping. This chief recommendation involved sowing and reaping twice a year instead of the traditional practice of letting the fields lie fallow in the dry season.[275] Intensified agriculture for the small holders demanded twice the nutrients and moisture from the same soil as well as twice the work, so that they may compete with kinds of capital being generated by their large holder counterparts. Traditional knowledge relating to soil vitality and the need to rest one's soil at given intervals was to be suspended. The extension departments of the universities were to encourage this practice above all others.[276] Second, was to expand HYV usage on small farms with a focus on the dwarf wheat variety in Buduan, and the dwarf rice variety in Tarai. Finally, it recommended the stimulation and support of diversification of small farm production beyond cereals into farm businesses, dairying, poultry, and processing. This final programme would become increasingly important as prices were bound decline with increased production. The first two programme recommendations are completely consistent with the precepts of the Intensive Agricultural District Programme and reveal nothing new about the intentions of the IAP or the agricultural research priorities of the 1960's. The final recommendation is relatively unique however and points to the impact of village level social science research. The local knowledge which was published in the report indicated an awareness of a more nuanced rural economy then the singular focus on wheat and rice noted previously. The data revealed the complex interaction between various elements of farm life which had previously been ignored or unstudied by the agriculture universities. While many of these interactions were neglected or outright criticized at least some attention was channelled into the prospect of diversifying farmers' income possibilities through means which were already available on the farm. The emphasis on a diversification of crop research based on locally available varieties and the expansion of local cottage industries are chief among these innovations in outlook. In this way indigenous knowledge, though heavily filtered and diluted by its journey through the channels of formal social science research, was made known to a global

[275] *Ibid*., p.127.
[276] *Ibid*.

audience and impacted the course of development and future scientific inquiry. The measure of the reports' impact is not within the scope of this study, but a copy of the distribution list was obtained indicating that 21 research institutions and universities in India received copies, including the IARI, the IIM, the "Fertilizer News", and the Fertilizer Association of India. Copies were also sent abroad to social science universities in Switzerland, the American Agency for International development, the American embassy, and USAID.[277]

Collectively the reports compiled under Gilpatric's guidance mark a shift in the quality of interaction between indigenous knowledge and formal science. The previous accumulation of IK came largely from germplasm collection and took place almost incidentally to the larger goal of increasing the genetic resources available to Indian scientists. That information which accumulated on the data collection sheets of the late 50's and early 60's such as cultural practices and culinary uses of crops went largely unpublished. It did however set the foundation for future plant research while being incorporated irreversibly into the agronomic practices of the IARI, as well as the other international institutions which participated in exchange programs. The shift in the focus and methodologies of research which resulted in the social science reports mark the next significant moment to be examined. The social science reports of the late 60's and early 70's specifically collected data pertaining to knowledge of rural inhabitants and intended to disseminate this knowledge as widely as possible. However, the purpose of such dissemination was to further promote a class biased technological package designed by reductionist scientific methods which encouraged uneven wealth creation. The IK contained in the reports was thus heavily influenced by the assumptions and methodology which furthered this agenda. Therefore, while the inclusion of social science research enhanced the data pertaining to local knowledge, the process used to gather this information and the purpose to which it was applied were still governed by the central contradictions of class bias and reductionist science. Regardless, the unique perspective provided by farmers sharing their day to day concerns set a precedent for future agricultural development strategies. Despite the nomothetic drive of social science to be treated as an empirical equal to its

[277] "Request List". New Delhi Field Office Collection. Series 2, Box 148, Folder 1080.

natural science counterparts, the making known of knowledge previously specific to small farmers allowed a rare exposition of the limitations of the research priorities at formal agricultural institutions. Although the final report unabashedly praised the potential of the HYVs it recognized for the first time a number of critical boundaries of that new technology. Therefore, despite its numerous shortcomings, Gilpatric's project empirically demonstrated that local knowledge could yield practical value by unveiling the concrete problems routinely faced by small farmers. Even though that data was largely filtered through the reductionist quantification of Gilpatric's computer analysis it contributed to the creation of a legitimated space for IK within which further research priorities and policy measures could be influenced. However, environmental degradation at the hands of double cropping, monocropping, as well as fertilizer and pesticide application was only beginning to be realized and had not yet begun to raise alarm bells. Similarly, the social toll of class stratification, crop price fluctuation, and gender exclusive programmes had not been fully calculated, or were still being ignored by policy makers. However, in the years to come the increasing demand for inclusion from the marginal segments of society, as well as the emergence of a new research community would bring about significant change in the diffusion of indigenous knowledge.

ICRISAT and the Institutionalization of Rockefeller Innovations

The IAP officially ended in 1972 with the New Delhi Office closing a year later. Just like the RF's efforts earlier in Mexico, the aim of the IAP was not to remain indefinitely in the country of operation, but to provide enough initial support for the momentum to be continued without Foundation assistance. The Foundation did not depart without leaving an institutional legacy in its wake however. In addition to its assistance in augmenting the graduate school at the IARI, the RF also played a prominent role in the establishment of a new international institution of the same calibre and purpose as the wheat and maize improvement center (CIMMYT) it initiated in Mexico. The Ford Foundation joined with the RF in the establishment of a second international center in the

Philippines in 1960 which specialized in rice.[278] The HYV rice used in India originated from this center. Two other crop/climatic specific international centers were established by the late 60's by joint effort of the two foundations and it was realized that broader support would be necessary to "achieve their stated goals of alleviating poverty and world hunger." [279] In 1968 the Rockefeller Foundation hosted an informal meeting with representatives from the United Nations Development Program, the Food and Agriculture Organization, and the World Bank at the Foundation's Center in Bellagio Italy.[280] Robert Macnamara, then head of the World Bank, proposed the founding of a consultative group to coordinate the funding of the burgeoning network of international research centers. The Consultative Group on International Agricultural Research (CGIAR) was born at this meeting and a mechanism of perpetual funding for the international centers secured.

In 1972, the first new center to be established under the aegis of the CGIAR was the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT).[281] Born the same year the Rockefeller Foundation officially exited the subcontinent, it was established with contributions from the Rockefeller and Ford Foundations, as well as from the World Bank. Annual funding continues to be provided by the World Bank through the CGIAR.[282] The institute was located just outside Hyderabad, in the South Indian state of Andhra Pradesh, a semi-arid region which was far away from the Green Revolution states like Punjab and Uttar Pradesh. This location is important not only for its establishment outside the IADP areas, but also because of the contents of an intriguing letter found at the Rockefeller archives. Charles Dennison, the vice president of the world's largest fertilizer manufacturer, the International Minerals and Chemical Corporation (IMCC), wrote to the IAP Field Director, Guy Baird on May 26th1970 regarding a "proposal for an agro-industrial research and training project for Andhra Pradesh."[283] The International Minerals and Chemical Corporation was one of the first overtly corporate players in the development field, perhaps more so than any

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[278] Mahendra Shah, & Maurice Strong. *Food in the 21st Century: From Science to Sustainable Agriculture.* (Washington: World Bank, 2000), p.56.
[279] *Ibid*., p.57.
[280] *Ibid*.
[281] *Consultative Group on International Agricultural Research*. (Washington: CGIAR, 1980), p.26.
[282] Mahendra Shah, & Maurice Strong. *Food*. p.57.
[283] Letter from Charles Dennison to Guy Baird, May 26th, 1970. New Delhi Field Office, Box 90, Folder 589. p.1.

other enterprise concerning agriculture in the 60's and 70's.[284] In past collusion with the RF they had sponsored studies in Mexico in the early 60's "which began to crystallize around a body of research data supplied by the Mexican Agricultural Program of the Rockefeller Foundation".[285] This study was concerned with what "private, profit-making corporations [could] do more directly than in the past, to accelerate the application of existing and improved practices of growing, harvesting, conserving and distributing foodstuffs throughout the hungry areas of the world."[286] Describing the experience of one of IMCC's corporate international partners in India, Coromandel Fertilizers Limited, Dennison relates how difficult it had been to encourage fertilizer sales with the high degree of risk and investment involved, especially in poverty prone, semi-arid regions. For this reason the IMCC was again seeking RF assistance to externalize the costs of the research required to effectively market and develop fertilizer technologies in a "hungry area of the world". The letter relates how "the agro-industrial research and training project could make a real contribution to understanding and speeding the agro-industrial process at this critical time. I would also emphasize that if the project could be organized in Andhra it could be replicated rather rapidly".[287] Coromandel established one of the first foreign fertilizer manufacturing plants in India in 1966 thanks to the help of the food aid deal mentioned in the first chapter. This deal denied state control over the pricing and distribution of private fertilizer sales along with the government's 51% stake in joint ventures in the fertilizer industry. The Coromandel plant was built by two companies, the IMCC and Chevron, both of whom maintained partial control of the venture into the 80's. [288] Mobil Chemical was contracted to ship sulphur from Canada and phosphate from Florida to the plant during the length of its operation. Mobil and Chevron's ties to Rockefeller interests hardly require elaboration. It will suffice to say that petroleum was an essential component for the manufacture of fertilizer and the oil giants Chevron and Mobil were two of the offspring of John D Rockefeller Senior's goliath, Standard Oil.

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[284] Joe Townsend, & Robert Golub. "Malthus, Multinationals, and the Club of Rome" in *Social Studies of Science*, (May, 1977, Vol. 7, No. 2,), p. 217.
[285] Simon Williams. "Popular Capitalism: A Selective Route to Agricultural Development" in *International Relations*. (1970: Vol. 3, No. 457.), p.470.
[286] Ibid., p.459.
[287] Dennison/Baird, "Letter". p.2.
[288] W.D. Postgate. "Fertilizers for India's Green Revolution: The Shaping of Government Policy" in *Asian Survey*, (Aug 1974: Vol. 14, No. 8), p.740.

Whether or not the ICRISAT was the end result of the vaguely defined "agro-industrial research and training project" mentioned in the letter is not explicitly revealed. However, Baird's affirmation of Dennison's request, the absence of any other major international fertilizer project in Andhra in the 1970's, previous RF collusion with the IMCC, RF involvement in the initiation of the Andhra Institute, and the timely establishment of ICRISAT the next year are all indications of this possibility. Furthermore, the CGIAR's commitment to propagating GR technologies, especially fertilizer is well documented as its funding body, the World Bank ensured. In the 1960's the WB was documented to "put a great deal of pressure...especially on the Indian government, to encourage multi-national corporations to invest in local production capacity"[289]. Dennison's dialogue with Baird constitutes early empirical evidence overtly linking corporate interests with GR programming and the RF. The links it exposes between Rockefeller corporate interests Chevron and Mobil cast substantial doubt on the impartiality and altruism of the IAP as well as the entire global RF campaign against hunger. The international class interests revealed by this conversation force a critical read of any RF or CGIAR project involving capital intensive inputs, including the work of the ICRISAT, and further corroborate the bourgeois nature and function of the Green Revolution.

ICRISAT was a separate entity, but it represents the continuity of the work of the Rockefeller Foundation and the evolution of the IAP, just as the CIMMYT, the first CGIAR institute, represents the continuity of the RF's Mexican Agriculture Program (MAP). It was also one of the most important research institutions actively engaged in the process of indigenous knowledge diffusion. Long term village level studies conducted by the Institute sought to "gain an intimate understanding of traditional agriculture in its matrix of cultural attitudes, economic constraints, and living patterns".[290] This data was used to determine farmers' needs as well as their attitudes regarding risk and innovation, and formed the basis for the institute's on-farm experiments.[291] The process by which this took place is of importance to the present study. ICRISAT emerged from the Green Revolution as a pioneer of new methodologies and concepts, such as farm systems research. Accordingly, this

[289] Ibid., p.742.
[290] Consultative Group. p.30.
[291] *Ibid*., p.30.

formal scientific institution's historical contribution to the diffusion of indigenous knowledge from India is unequalled and thus warrants further investigation. The documents in this section consist largely of internal ICRISAT publications which were located at the IARI's library in Delhi as well as that of the Indian Institute of Management in Ahmedabad, India's premier university for agricultural management degrees.

ICRISAT's village level engagement was a priority from its inception and actively documented and incorporated local knowledge into their crop research programs. This is evidenced from a number of sources and none better that an internally circulated publication entitled "Manual of Instructions for Economic Investigators in ICRISAT's Village Level Studies" published in 1978. This represents a revision of an original volume published in 1975.[292] With planning beginning in 1974, village level studies (VLS) began at the ICRISAT the next year. The VLS program represents the first institutionalized forms of indigenous data collection in India and the basic precepts which guided it are unambiguously articulated below:

> The study of traditional systems-as reflected by farm level resource endowments and utilization-may hopefully i) reveal some elements which could be refined and incorporated in the prospective technology package, ii) highlight physical, biological, economic, and institutional constraints which condition the traditional system of farming and (unless alleviated) may prove detrimental to the spread of prospective technology. In brief, the VLS are primarily designed to collect relevant farm-level details to assist ICRISATs research system in its task of generating technology suited to the needs and means of SAT farmers. This is achieved through observing and monitoring what farmers do and why they do it.[293]

This revealing excerpt made known that for the first time in the period of Green Revolution politics, in unabashed language, that a formal scientific institution openly recognized the value of farmer knowledge and "traditional systems". Such knowledge was valuable because of its potential to assist in the generation of technology which was not dictated by development planners or international foundations, but rather directly related to the "needs" and "means" of the Indian farmer, at least those who dwelt in the SAT.

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[292] Hans Binswanger & N.S. Jodha. *Manual of Instructions for Economic Investigators in ICRSIAT's Village Level Studies Vol. 2.*(Patencheru: ICRISAT, 1978), p.1.
[293] *Ibid*.

Villages were chosen to represent a broad range of "agroclimatic sub regions" in the SAT parts of India. [294] Villages which had special programs or above average support or resource transfers from outside, such as government fertilizer subsidization, or those located near towns were not to be considered.[295] Individual households were categorized as either cultivating households or labour households. The former referred to any household which derived most of their income from their land and whose farming operation consisted of no less than 0.5 acres. The latter referred to any household which received most of its income from daily labour, which included wage labour on neighbouring farms, but did not include those individuals who were skilled or trade labourers such as blacksmiths, carpenters, or potters.[296] No indication is given as to the maximum size of farm to be considered, and thus one must conclude that no preference was allotted to either small or large farmers. Furthermore, the inclusion of large, or at least wealthy farmers, in the VLS has to be assumed due to the inclusion of criteria for data collected from money lenders. Such criteria included recording interest rates charged and number of loans given.[297] This indicates a level of knowledge collection which crossed rural class boundaries as previous data, especially from the Gilpatric reports, suggested that money lenders were often large landowners.

From each village a random sample of 30 households was to be taken from the cultivator and 10 from the labourer categories. After a household census took place the survey "schedule" consisted of gathering such data as household members, plot and crop rotation, animal inventory, farm implement inventory, household transactions, monthly prices, stock inventory, debt and credit levels.[298] Consumption patterns were also recorded and included money spent on food, tea and coffee, clothing, medicines, travel, fuels, ceremonial expenses, and "narcotics". Data on certain purchases, such as seed inputs, were to be tracked to the source of purchase.[299] This data was to be recorded as statistics when possible and when numbers could not be used data was to be uniformly recorded accordingly to a unique coding system. Each item was matched to a different two letter

[294] *Ibid*., p.3.
[295] *Ibid*.
[296] *Ibid*., p.4.
[297] *Ibid*., p.9.
[298] *Ibid*., pp.6-7.
[299] *Ibid*., p.132.

code and then charted. Standardized formats were given for the coded and statistical charts and reports were to be compiled every two weeks for submission to the office in Patancheru for processing.[300] This left little room for elaboration in data keeping in the initial VLS. Resembling Gilpatric's statistical holism, qualitative farm level knowledge collected by ICRISAT was condensed into a quantitative chartable data set and stricken of its resemblance to the individuals from whence it came. The limitations imposed on the village level workers are understandable as the processing and interpretation of qualitative data from hundreds of individual households may have reduced the efficiency of its application. On the other hand it also prevented the garnering of unique instances of farmer innovation, anomalous practices, or novel problems, while also remaining susceptible to the familiar nomothetic trap.

One qualitative departure from the Gilpatric methodology related to the concept of rapport. The manual notes that "our rapport with the village is one of the key factors for successful working of the village study project. Investigators are free to use their own methods and styles for building rapport."[301] Village level workers were not free to interact as they pleased however and a number of required rapport building methods were listed. Village level meetings were to be a regular practice and close contact was to be maintained with school teachers and other educated people in the village. "Frequent visits to the places where farmers assemble during evenings are also recommended. However, do not engage in extension activities. It is very important that investigators record the data from the respondents themselves, preferable in their houses or fields…Try to avoid having a third person at the interview."[302] Such selections reveal the complex demands required in an increasingly nuanced interaction between formal scientific agents and the peasant producers of indigenous knowledge. This research was a far cry from the usual plant science practice of walking rows of test plots and taking height or growth rate measurements from stationary and passive botanical subjects. The data sought by the VLS was not so passive or measurable. The individual farmers held the power of local knowledge in their hands and there was no guarantee that such power would be freely

[300] *Ibid*.
[301] *Ibid*., p.8.
[302] *Ibid*., pp.8-9.

relinquished to strangers. The difficulties mentioned in the third Gilpatric report regarding interpretation of credit data revealed this problem earlier. One way around incomplete personal data was to build trust with, not only individual respondents, but also with influential members of the community who would not even take part in the survey. This process of legitimation and "rapport" building was needed to ensure an accurate and consistent flow of data from the villages and represents a methodological evolution in the framework of indigenous knowledge collection.

Rapport was only one new element of an emerging systems approach to agriculture embraced by the ICRISAT. The approach attempted to escape the linear causality of previous technology transfer models and explore new points of interaction in the countryside. In a document published from the proceedings of an international symposium on development and transfer of technology, ICRISATs engagement with FSR is detailed. The paper delivered at the symposium was entitled "Farm Systems Research and Technology for the Semi-Arid Tropics" and its author, Jacob Kampen, writes that a Farm Systems Research Program (FSRP) was included in ICRISAT's initial mandate, which was written in 1971.[303] The reason was that FSR "contributes to raising the quality of life in the SAT through interdisciplinary and cooperative effort to improve the use of natural, human, and capital resources."[304] The interdisciplinary nature of the program ensured that social scientists, such as agriculture economists, would not be excluded. Neither would farmer input be excluded from the program since "on farm studies…involve farmers in appropriate technology development and…effective forms of group action."[305] However, Kampen notes that the CGIAR/ICRISAT FSRP was still evolving, especially regarding cooperative research networks and technology transfer models. The first FSRP began in 1972 and at that time "FSR was a vague, unknown phrase in the SAT".[306] By 1979, the time of the paper's publication, ICRISAT was providing leadership across the world in this regard thanks to its involvement in cooperative research networks and on-farm studies. Kampen lends credit for the rapid success of the program to his

[303] Jacob Kampen. "Farming Systems Research and Technology for the Semiarid tropics" in *Proceedings of the International Symposium on Development and Transfer of Technology for Rainfed Agriculture and the SAT Farmer*, ICRISAT Center Patancheru, Aug 28-Spet1, 1979, (ed).Vrinda Kumble. (Patancheru: ICRISAT, 1979.), p 39.
[304] *Ibid*.
[305] *Ibid*., p 40.
[306] *Ibid*.

institution's cooperation with the IARI, the Indian Council on Agricultural Research, and international collaborations with Brazil, and unspecified African nations. This emphasis on collaboration would be a characteristic feature of ICRISAT policy since their extension division was relatively small and most of their technological dissemination took place through regional and national research institutions.[307]

The goal of the FSRP was to "generate economically viable, labour intensive technology for improving, utilizing, and conserving the productive potential of natural resources, to develop technology for improved land and water management systems…resulting in additional employment and better utilization of draught power."[308] It also sought to contribute to raising the "economic status" and the quality of life of the SAT by developing farm systems that "increased and stabilized agricultural output." Kampen validates his advocacy for the program with the inclusion of a number of comparative studies which contrasted the isolationist approaches of previous research with the interactive systems approach of FSR. For example, standard isolated trials of certain new varieties which were conducted under the optimal conditions of the ICRISAT's test plots produced yield increases, but these increases were 300% greater when combined with multiple improved techniques from different departments. This "synergistic" and interdisciplinary spirit is what the program was intended to promote. [309] One of its central features was the incorporation of indigenous knowledge through on-farm research. "On-farm research provides for participation of farmers in the development of technology, ideally agricultural research does not start at the research station; it starts on farms. Only in this setting will feedback to the research programs be generated. Such feedback is considered essential to assure the continuing relevance of technological solutions to the problems of farmers."[310] Such quotes allude quietly to a previous decade's focus on the development of technology which was largely irrelevant to the masses of Indian farmers. Green Revolution technology was not only irrelevant to the majority of farmers in the wheat and rice growing regions of the North, since they neither possessed the capital, irrigation, or land size required to grow the

[307] *Ibid*., p.52.
[308] *Ibid*., p.51.
[309] *Ibid*., p.52.
[310] *Ibid*., p.53.

HYVs, but was especially irrelevant in the SAT where little to no irrigation infrastructure existed and where wheat and rice were not dominant crops. Later ICRISAT publications would point to the benefit of the VLS, praising the value of the "considerable microeconomic data on Indian households".[311]

ICRISAT's commitment to farmer knowledge is evident from more than just its collection of village level data, but also in its internal research and policy recommendations. In a document which evaluates the impact of the Institute's research a number of conclusions point to the value of local knowledge both within the formal research network and for government policy. For example, as part of its agricultural modernization campaign with an emphasis on mechanization, tractor subsidies were put in place by the Indian government. ICRISAT village level studies of tractor usage determined that such mechanization decreased the local labour demand without increasing yield.[312] These subsidies also had the effect of shifting competitive advantage to large farmers.[313] The results of this study in turn led to the Institute recommending to the government to eliminate tractor subsidies. Another author in the document notes that large farmers who adopt a new technology, which is designed to improve production, can lead to increased income, which in turn leads to investment in mechanized production methods and decreases overall employment. For developing countries in dry or arid zones, "labour intensive, rather than capital intensive technology is the right choice for agriculture."[314] This distinction is important in light of previous attempts to impose nationwide solutions to local or regional problems in a country whose regional variance in soil conditions, average rainfall, and income distribution are extreme. Quotes such as this represent a drastically different approach to agricultural priorities at research centers. In stark contrast to the Green Revolution era Rockefeller documents, indiscriminate wealth creation and technological modernization was deferred in preference to that kind of technological development which addressed the individual needs of a diverse range of Indian farmers. It also contributes further

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[311] R.P. Singh. "New Technology and Differential Effects on employment and Poverty" in *Evaluating ICRISAT Research Impact: Summary Proceedings of a Workshop on re. Evaluation and Impact Assessment, 13-15 Dec*, (eds) MCS Bantilan and PK Joshi. (Patancheru: ICRISAT, 1994.), p.130.
[312] *Ibid*., p.68.
[313] *Ibid*.
[314] R.P.Singh. *New Technology.* p.130.

evidence in debunking the Green Revolution myth regarding the universal applicability and scale neutrality of the capital intensive technology. Another quote from the same document further reinforces this point when it notes that "contrary to popular belief, many new technologies are not neutral to scale...even farms of the same size differ significantly in effective size because of different soil quality and water availability"[315] This emphasis on variance of local conditions, even regarding farms of the same size, demonstrates a new scientific approach which no longer favoured universal solutions to unique local problems. It also cast the farmer in the new role of active research participant and as the starting point for laboratory work, rather than the farmer's previous, Green Revolution role as the passive recipient of high technology. The novel inclusion of rapport in the VLS is also an indication that research methods were beginning to approach technology transfer in a more dialectical way, namely as a dynamic and interactive social process with open ended questions rather than as a mechanical event with predetermined parameters.

[315] *Ibid*., p.83.

Chapter 3- Counter Revolution: Anil K Gupta and the Development of the Socio-Ecological Paradigm

The shift in the farmer's role in formal research networks was not only taking place in a single international institution in India's South. By the early 1908's many other donors were actively funding village level research of the social science persuasion, with an emphasis in local knowledge. Since the Rockefeller Foundation formally left India in 1973 a number of other large donor agencies began work in the country. The post-Green Revolution age saw a flourishing of non-governmental players supported by the generous contributions of new foreign donor agencies. New actors such as the Swiss Agency for Development and Cooperation (SDC) took an interest in the changes taking place in the Indian countryside and funded research projects outside of the Indian government's established research networks. This kind of research forms the final historical moment in the diffusion of indigenous knowledge to be discussed in this paper. It represents the most diverse form of information gathering as well as the most flexible and adaptive. Without the shackles of a lumbering bureaucracy or the ideological assumptions of large formal scientific institutions, many non-governmental individuals and organizations were able to capitalize on the funding of large foreign donors to form an alternative paradigm of knowledge production and dissemination.

The change in sources of international funding and the increasing presence of non-governmental development programming coincided with a global intellectual shift which placed greater emphasis on the social aspect of development, as well as environmental aspects. According to Ramachandra Guha, the early 1980's was an especially important era for the social sciences, sociology in particular, insofar as it marked the normalization of ecological concerns.[316] The tradition of combining social and ecological issues in the social sciences certainly predates this period, being traced back in India as far as 1925 by Guha. Anil Gupta traces his own influences the work of Y.P Singh and to two graduate theses he guided in 1967.[317] These were some of Gupta's first encounters

[316] Ramachanrda Guha. "Introduction" *in Social Ecology*. Ramachandra Guha (ed). (Delhi: Oxford University Press, 1994), p. 10.
[317] Anil Gupta. "A Note on Internal Resource Management in Arid Regions Small Farmers-Credit Constraints: A Paradigm" *Agricultural Systems*. No. 4, Vol.7 (2009), p.157.

with both the terminology of "indigenous knowledge" and the concept of farmer innovation. Guha notes that the number of major sociological works emphasising ecological elements beginning around 1982 marks this period as the start of a broader methodological shift within the social sciences.[318] Central to the new social ecology perspective was an "awareness of the *interdependence* of the biophysical and socio-cultural domains".[319] Crucially, it was the "reciprocal relations" between the "ecological infrastructure", (consisting of soil, water, forests, biological diversity) and the economy, polity, culture, and social structure that concerned the new research agenda.[320] Again, it is possible to see in the new methodologies elements of the dialectic approach emerging, specifically in the increased emphasis on multidirectional causality, the centrality of interactions, and reciprocal influence mentioned by Lewontin and Levins.

One of the most influential individuals pioneering a perspective emphasizing the interrelation between social and ecological factors as they directly related to agricultural development was Anil K Gupta. His contribution to the field of indigenous knowledge in particular within India is colossal and the evolution of his methodological contributions provides a suitable case study to analyse the finer points in the development of current research paradigms. Furthermore, his founding of the Honey Bee Network NGO serves to mark a milestone in the diffusion of IK. This database of grassroots innovations remains the largest of its kind in the world and the process which inspired its establishment is marked by key methodological contributions and insights.

After convocation of his Masters in biochemistry with a focus on genetics, Gupta spent a year in Delhi where he worked for the District Project Planning at Indian Institute of Public Administration. Here engaged in field work related to the diffusion of credit in drought prone regions. These experiences gave him firsthand knowledge of the burdening power dynamics governing both credit and research policy. He also had the fortune to work with some influential

[318] Guha. *Social Ecology*. p.10.
[319] *Ibid*., p.5.
[320] *Ibid*.

researchers who insulated him from "the frustrations of indifferent leaders."[321] Among them were professors of both social and natural science. Kuldeep Mathur coordinated the project and was influential in teaching this biochemistry graduate social science methods as well as how those methods related to society. Professors Y.P Singh and S.N Kakar also contributed to Gupta's development during this period, the former "inculcated...respect for oddity and indigenous knowledge"[322] while the later the enhanced his methods within the natural sciences.

After this period in New Delhi he then went to the Indian Institute of Management in Ahmedabad where he came into contact with the social science work done by D.K Desai. This was the same work which led Gilpatric to seek Desai's advice for the RF reports. While at the IIM Gupta was approached by the SDC to conduct a social science study dealing with agricultural credit. The SDC had read some of Gupta's early 1980's papers championing a new developmental research paradigm which emphasised knowing "the internal dynamics of a rational small farmer."[323] In other words, Gupta theorized that effective development strategies hinged upon not only improving the manipulation of internal variables of government projects, but doing so in a way which was in harmony with the decision making process of rural inhabitants. Specifically, it was the dynamics of the "internal resource management of different classes of farmers" that needed more data.[324] This could only be done by designing project strategies which accounted for "micro level relationships[s] between project objectives and individual resource flows, hence the need for re-examination of macro assumptions to make projects deliver the goods at the micro level."[325] This paradigm fit perfectly with the SDC's desire to determine whether their mandate of channelling aid to the poorest segments of the population was being fulfilled. They were under the impression that money given to the Indian government was "fungible" and so they asked Gupta to evaluate their substantial line of credit for its effectiveness in reaching the poor.[326] Gupta suggested that the best way to determine

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[321] Anil Gupta. "Roots of Creativity and Innovation in Indian Society: A Honey Bee Perspective". *Wastelands News*, Aug-Sep 1996, Vol..XII, No.1, p.3.
[322] *Ibid.*
[323] Gupta. "Internal Resource Management" p.157.
[324] *Ibid*., p.160.
[325] *Ibid*., p.161.
[326] Interview with Anil Gupta March 12, 2011.

the efficacy of the SDC's credit program would be to enter one of India's poorest regions which had established institutions of state bank credit and conduct village level studies there. If the studies found that the rural inhabitants had access to credit services and were able to take advantage of those services in a meaningful way, then the SDC's aid would have been effectively spent. The SDC agreed to the methodology and funded the research project. Gupta had a secondary objective which he hoped his novel methodology would help achieve. This was to "demystify the power of the social scientist"[327] by mobilizing a participatory research approach with a diverse selection of researchers. The selection was to include more than rural sociologists, but also those members of rural institutions who were part of the rural credit delivery mechanisms; the main "actors in the situation".[328]

The principal actor was the SDC. The Agency acted as the body through which official Swiss government aid flowed, and still flows, to developing nations.[329] Specifically, the Swiss government had released 40 million francs in bilateral aid to an Indian agency responsible for the distribution of credit related to agricultural development, the Agricultural Refinance and Development Corporation (ARDC). The ARDC was established in July, 1963 by an Act of Parliament as part of the third five year plan's (1961-66) attempt to boost production, and therefore investment, in the agriculture sector.[330] The corporation's main role came in refinancing, assisting, and advising state land development banks located across the country.[331] It was part of the aid deal that a report should be published relating rural credit needs especially with regard to poverty prone regions. The increase of lending to small farmers, especially for long term investment in agriculture, was of central importance.[332] It was also the purpose of the report to establish and promote a continuing dialogue among the rural banks, NABARD, and farmers. Again, as with the Gilpatric and ICRISAT village level work, a major local

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[327] *Ibid*.
[328] *Ibid*.
[329] Anil Gupta. *Impoverishment in Drought Prone Regions: A View from Within*. (Ahmedabad: SDC/NABARD/IIM, 1983), p.9.
[330] "NABARD, Agricultural Refinance and Development Corporation" last modified 2011. http://www.nabard.org/index.asp
[331] *Ibid*.
[332] *Ibid*.

knowledge publication would be produced under the auspices of furthering the flows of financial capital.

The findings of the project were published in a report entitled *Impoverishment in Drought Prone Regions: a View from Within* and published in 1983. Dedicated to the semi-arid region of Maharastra in central India, the title alludes to the fact that the report would bring attention to an area which would not have fit the criteria of the IADP in the GR period. Gupta, the report's principal author, hoped the study would initiate some change in the macro level response to farmer's micro level problems, as well as improving the understanding of the SDC of rural problems at the village and family level.[333] This study was expected to "provide a basis for exploring, experimenting, and institutionalizing the farmers' say, not only in the implementation of policies but also in the designing or redesigning through effective feedback." [334] The novelty of the above quote is not that "farmers' say" is a central feature to the report, but rather that the report readily admits that it is not an absolute authority on farmer/researcher relations. The inclusion of the words "exploring" and "experimenting" indicate that the methodology being used in this data collection is not set in concrete and has room to adapt as circumstances dictate. The recognition of the need to design and redesign policies in light of information provided by feedback mechanisms also represents a novel admission of the research community regarding the need to adapt conclusions based on village level input.

Gupta contextualizes the central issue of credit in the opening pages of the report. Noting the persistent presence of a deficit in rural household budgets in semi-arid and arid regions in India, he writes that "credit policies are one of the most important strategic interventions in reducing or eliminating this deficit. The process through which deficit manifested "in a household budget has a vital bearing on the way the farmer household responds to any external stimuli for development".[335] Yet demand for credit was lowest in drought prone regions where rural household deficits were highest. The report sought to understand the reasons behind the lack of demand for credit in a

[333] Gupta, *Impoverishment*. p.10.
[334] *Ibid*., p.11.
[335] *Ibid*., p.14.

capital scarce region. Five objectives were set to guide this line of inquiry and are worth mentioning because they outline the framework which guided the collection of the village level knowledge. First, the study worked to "develop profiles based on the farmer perspective about the poverty process" in the respective district.[336] Secondly, it sought "to identify the finer nuances of adjustment mechanisms with risks by the small farmer which can be sustained or strengthened through credit interventions."[337] Third, to see to what extent the low demand for credit is explained by a lack of need or capacity to absorb capital in a given market, institutional limitations, or inflexible repayment schedules. Fourth, the report wanted to identify those rural enterprises, whether agriculturally related or not, which could benefit from the support of institutional intervention. The capital absorption capacity of village cottage industries and petty commodity production enterprises were emphasised. Finally, the subject of rural "stratification" was to be explored.[338] It is apparent in these objectives that the documentation of indigenous knowledge is again designed to take place with reference to its relation to credit. While the theme of credit runs like a red seam through the historical fabric of the social science data to emerge from India's agriculture sector, the methodology of the SDC study sets it apart from work published previously.

The SDC report is an important work to review when considering dissemination of indigenous knowledge and interactions with formal research networks due to its unique methodological assumptions. In the early 1980's it was one of the first village level studies to pioneer the concept of participatory research. The idea was that any meaningful form of inclusive or participatory development would have to be accompanied by inclusive or participatory methods of interacting with the peasantry. In Gupta's words, "the idea was that if one were to evolve a participatory paradigm for the development of small farmers, one will have to first establish the same spirit in the methods of inquiry."[339] To achieve this new "participatory paradigm" the study would adapt its approach based on the feedback provided by both the experiences of the rural participants and the researchers. Rather than imposing an inflexible research methodology

[336] *Ibid*.
[337] *Ibid*.
[338] *Ibid*.
[339] *Ibid*,. p.16.

constructed with pre-set assumptions, the new methodology had room to adapt and change its line of inquiry based on what the participants revealed to be most relevant. To accomplish this the study was divided into four parts. In the first stage a workshop was held at the district level to recruit participant households and village level researchers. The first meeting included high school students, graduates, post-graduates of social science programs, project organizers of voluntary agencies, field officers, and managers of the cooperative and commercial banks. At this meeting, the purpose and methodology were outlined "with the flexibility to change in response to feedback from participants in the workshop."[340] Farm families were selected based on a number of criteria with emphasis on selecting farmers "who would not normally participate in any group discussion or political activities in the village, who would stand in the rear even if they came to the meeting and who would not throng around any outsider who came to the village. The argument in such a selection was that he should be someone who was never heard by those who tried to either deliver goods or services, or enquired about the problems of the poor." The study not only sought out the poverty-affected individuals in drought prone regions, but also the most socially marginalized individuals within that segment of the population.

Unlike previous documents discussed so far, the study encouraged participation by rural women. While the majority of participants were male, one woman researcher was selected to stay with a tribal family for a month in order to provide a woman's perspective on the subject. She was asked to speak with village women and especially the wives of farmers who were participants about the same issues.[341] In this way researchers recognized women's knowledge as an independent and important sphere within the local knowledge spectrum. Even if it was largely underrepresented in the study with only one female researcher, the inclusion of a gender sensitive view of knowledge demonstrates the increasing complexity of the emerging systems-approach to agricultural research.

In this first stage of the study researchers stayed with the selected family for one month in order to develop a rapport with the farmer and communicate to him the logic of the study so that he

[340] *Ibid*.
[341] *Ibid*., p.20.

could actively participate as much as possible. This lesson is consistent with the ICRISAT's strategy which recognized the value of rapport building when gathering village level data and is a notion which would later become a staple of participatory research methods. An example from the report illustrates the very real need to ensure that adequate rapport was developed in a case community. One full time researcher recorded an "interesting" rumour which was being spread in the surrounding villages about the SDC village level researchers.[342] When speaking with a villager named Sondai the staff was informed of a rumour she heard from a neighbouring village which insisted that "researchers were not good people and that they will put some poison in the wells which will kill them all...we later suspected that some of the people who had been keeping the poorer Lamoans and others in their exploitative clutches must have spread such rumours not only to alienate them from us but also to frighten the people from telling anything to us."[343] Records such as this indicate the village level politics which were also a large factor dictating the kinds of data which would be collected by village level workers. Mistrust and established village hierarchies were real factors limiting the data available to researchers and the development of rapport building mechanisms is an historically significant process in overcoming this. This instance is also important for its illumination of the subtle factors which more than likely influenced a great many village level studies which took place in years previous. Without similar qualitative feedback in the Gilpatric or ICRISAT reports it is impossible to say how this phenomenon changed over time. However, it is possible to say that the quantitative format of the previous reports would have limited the ability of researchers to address such issues since they were guided by a far more rigid set of parameters when conducting data collection in the villages. Only the SDC report allowed for, and in fact encouraged, such anecdotal knowledge to arise. The previous reports examined so far were highly focused on statistical data collection, specifically income and expenditure data. Rarely if ever was there room left to include descriptive qualitative data such as detailed accounts of daily life, complex agricultural problems such as pests or disease, or the spontaneous knowledge contained in everyday rural interactions and rumours from the village down the road. The ability to include such valuable data is one key

[342] *Ibid*., p.190.
[343] *Ibid*.

advantage of the open format of the Gupta report and is indicative of the need for development planners to understand village level problems in more complex terms than graphs and charts were able to convey.

The need to dispel mistrust was a pressing concern, but it was not the only reason for building rapport in case villages. In a quantum leap from the RF documents a decade earlier, it was recognized that the farmer had to be granted his place as an active agent in the research process if meaningful development was to take place:

> No questionnaire was given to the researchers because it was felt that any *priori* list of questions would prove to be inadequate for relating realistically with extremely varied household contexts. To capture the finer details...it would be essential that flexibility was provided to the researcher as well as the farmer to lead the exploration in the direction in which the farmer wanted. Another important aspect of this phase was to document the mental constraints of the researcher which would considerably influence the way data was defined and collected. It was hoped that this benchmarking of the researchers would help us in discounting the noise from the data[344]

Each sentence of this quote reveals a new perspective on social science data collection in early 1980's Indian agricultural development. The staple of previous village level studies had been the questionnaire. This ensured a standardized line of inquiry which reduced the likelihood of researcher error or participants providing unwanted or irrelevant information. Conversely, the first stage in the SDC study was to remove barriers between researcher and participant and to encourage a dialogue of flexibility and reciprocity. The inclusion of researcher self reflection is another novel inclusion in this study. The initial workshops encouraged researchers to try to understand how their own limitations or experiences could affect the data they were about to collect. The methodological demand for critical self-reflection among researchers is one of the most striking features of this study and points to the realization of the limits of nomothetic positivism within social science research especially regarding observer bias.

[344] *Ibid*., p.17.

The next stage of the study reconvened all the researchers who then had the chance to convey their experiences and express their concerns. Of note was the common compliant among researchers about not having a questionnaire. The other major issue was to assess the claims by researchers that several households were not fit to participate. In response to this the third stage of the study developed a questionnaire and modified it for different regions according to the concerns of the researchers. At this point researchers returned to their villages and were encouraged to follow up links of the farmers, who at times were over a ten kilometre walk away from the researcher's place of residence. They were encouraged to "look at the village from the perspective provided by the case farmer, particularly, what he thought of and how he dealt with the village credit situation (formal and informal)." [345]

The final stage saw the compilation of data from a second gathering, this time of both researchers and participants. Here, participants were granted the chance to hear the reports generated by the researchers and to rectify any contradictions with their own experiences. Gupta notes that "the most important feature in this phase was that the entire case was to be shared with the famers' family by narrating it to all of them together. Not often are the findings of social science research shared with those who are 'researched'. In this study it was made clear that it was the case farmer who will decide about the validity of the interpretation of the data."[346] The author's attitude towards indigenous knowledge and past research methods is made clear in this passage. It is also made clear that although male farmer input may have been dominant in the data collection up to this point, the final gathering at least provided the chance for all members of the farm family to voice their opinion at the interpretations of the researcher. Such opportunities for reconciliation between the observations of researcher and subject were notably absent in all of the previous social science studies discussed so far. The publication ended with an appendix entitled, "Voices from Below" and contained a partial record of the responses made by farmers at this seminar. Without going into detail it will suffice to say that the common issue raised by farmers was their desire for some kind of

[345] *Ibid*., p.18.
[346] *Ibid*., p.19.

insurance on their loans. Events such as "non-conception" in livestock investments, crop failure, failure to find water when digging for wells, and other acts of God, were reported by farmers to be major risk factors when deciding to apply for a loan.[347] One farmer announced that several villagers from separate villages formed a group which intended continuing the dialogue which had begun between farmers and bankers. The year following the seminar the group reportedly organized a meeting later in the year in which 100 farmers and labourers met with a few bank officials. Unfortunately, this cross-class collaboration reportedly only led to frustration on both parts since the villagers' concerns could not be addressed by the low ranking officials the bank had sent.

The methodology pioneered by Anil Gupta placed a heavy emphasis on the relationship with the research participant. Each researcher was expected to participate in household duties such as harvesting, threshing, collection of fuel, etc. Case villages were visited regularly by local monitoring teams who compensated the case farmer for the researchers stay and assisted with any problems.[348] The only limitation was that researchers were asked not to use their own money to contribute to the household which was hosting them. Even under drastic circumstances there was to be no charity handed out and this was easier said than done, as one researcher who was forced to eat grass when his family's crops failed discovered.[349] The village level research was carried out by four groups of researchers and the case studies were organized into four sections based on this distinction. These four groups represented an interdisciplinary collaboration between bank agents and social science researchers and the inclusion of such a diverse staff of researchers demonstrates another methodological innovation of the report. The groups included fulltime researchers (social science graduates), bank officers, part time researchers (mostly post-secondary students), and voluntary agency workers.[350] Each case was divided into a village profile, case, and personal experience section. Of the four groups' submissions, the most nuanced and descriptive are those of the fulltime researchers. These accounts have the most uniform style and present the widest range of local knowledge. Many include village or homestead maps as well as a descriptive account of the daily

[347] *Ibid*., appendix, pp.14-15.
[348] *Ibid*,. p.22.
[349] *Ibid*., p.569.
[350] *Ibid*. p.23.

events in the families' homes and the broader village. Bank Officials accounts contained less such daily life descriptions but were more detailed in documenting the capital assets of their hosts, often accompanying their reports with a chart of such assets, their corresponding value, and the source of the cash or credit used to purchase the implements. The bankers were far more diligent than the other groups in recording the purchases of such things as fertilizers, irrigation, labour, seeds, radios, utensils, clocks, lamps, baskets, chairs. Part time researchers left the shortest contributions and their reports bore the closest resemblance to diary entries. They contained scattered maps and asset lists and were more inclined to include anecdotes from the farmer's daily life than were other researchers. Voluntary agent's reports were the least numerous, only representing four village case studies, but were overall well written and balanced accounts. Input expenditure was the universal feature of these accounts. Accounts of daily life are almost exclusively restricted to the individuals' relationship to these assets and credit.

Of the 573 pages of this colossal document, 503 pages represent the collection of village level reports written from the firsthand accounts of the four groups of researchers. The reports of the full-time researchers are put first and recommended by the author as the most informative since they displayed a higher "intensity of experience" than the others.[351] After a review of the study`s purpose and its methodology, the remainder of the publication written by Anil Gupta details the common findings of the questionnaires, provides analysis of the village and family case studies, and puts forward policy recommendations to the SDC and its affiliates. A number of these findings and policy recommendations contain a wealth of unique local knowledge and are worth going over in more detail.

One major conclusion of the study revealed that awareness of credit institutions was only part of the problem, citing the fact that most farmers knew of the existence and purpose of the rural credit establishments.[352] Still they did not apply for agricultural credit "because the way it was

[351] *Ibid*,. p.65.
[352] *Ibid*., p.43.

offered does not sound relevant to them in the respective endowment contexts." [353] Here, again we find agents of modernity, this time credit institutions, peddling their wares in villages without information on whether or not their products are relevant to its end users. The inherent value of such staples of modernity were apparently supposed to be equally relevant to all farmers the world over. In response to the irrelevance of credit options the report asked the question "how do we build feedback channels from farmers to policy makers so that the policies and programmes become more relevant to small farmers. Could institutions put premiums on such officers who demonstrate or document the irrelevance or decontextuality of a macro-policy for the concerned micro context? To sustain these efforts a different organizational culture is needed but a discussion on that is clearly beyond the scope of this report. However, the need for some such program arrangement cannot be overemphasized."[354] The village level knowledge gleaned from this study is the first to point to the fact that, just like the HYV package of inputs, the credit products and procedures available to small farmers seemed largely irrelevant. The report's emphasis on building "feedback" channels for local knowledge is another important recognition for 1983 since few such channels existed at that time.

One example from the case studies demonstrates the value of such feedback mechanisms in determining the relevancy of credit services. According to the study the lack of awareness regarding regional variation highlighted what Gupta refers to as the "ecological dimension". This aspect of the study was especially important when dealing with farmers due to the fact that climate and weather are key variables determining risk on the farm operation. This kind of risk is distinguished from credit ratings and refers to the risk farmers must calculate each year with regards to adverse natural conditions which may affect their operation. Gupta draws attention to the ecological dimension of the rural poverty issue when he notes that "the policies to stimulate demand for credit from farmers will have to take into account environmental difference and the consequent risk variations."[355] The problem of credit institutions overlooking regional variations of climate and ecology are brought to light thanks to the feedback channel provided by this report's documentation of local knowledge.

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[353] *Ibid*.
[354] *Ibid*. (emphasis in original)
[355] *Ibid*., p.56.

One case study in particular revealed that a common crop known as *bajra* had a high probability of crop failure, but still had a long tradition in the region. Loans to this region were therefore considered risky and few were granted to the *bajra* growers. Also, such growers recognized the inherent risk of their operations and supplemented or mixed the planting of this crop with others varieties to compensate for the potential failure of one or more. The problem was to ensure that the famers engaged in *bajra* cultivation were not excluded from access to institutional credit and that "institutional viability is not impaired by non-viable activity...The implication for the policy makers is that the farmers growing such crops need to be supported not only in a way that they can take the risk of growing such a crop but also that they are encouraged to grow crop mixtures. In terms of procedures if the viability of farmers and institutions has to be ensured it would mean that the scale of financing need not only be for a single crop as worked out so far but should be for a mixture of crops."[356] This case is important for several reasons. First, it relates a common tangible example of the how India's rural institutions were not prepared to deal with the diversity and complexity of rural life. More importantly however, it reveals an institutional paradigm which favoured a particular kind of agricultural production which was not indigenous to India, namely that of monocropping. Since the credit institutions did not have a mechanism to calculate risk for intercropping patterns, or mixed-crop farms, it discouraged producers who used this common traditional technique from acquiring loans. The report recognized that the traditional practice of intercropping represents a time tested mechanism of risk management, which was especially important in the drought prone regions where crop failure is common. The failure of the credit institutions to recognize this common village tradition and adapt their loan risk calculations based on regional specifications mirrors the HYV input debate in the exhibition of exaggerated self-confidence and disregard of local input.

A variety of farmers gave similar accounts of the irrelevancy of rural credit services. Many felt that the procedure was too difficult since land records had to be presented and these were often non-existent or held by individuals were reluctant to releasing them. Also, a "No Objection"

[356] *Ibid*. (emphasis in original)

certificate had to be obtained from the *Tahsildar*[357] and presented to the bank or coop, meaning that the famer would often have to approach the village`s landholding elite and get their permission before applying for credit.[358] Banks often wanted guarantees from local leaders who were not available or not willing to assist the small farmers. Even when the paperwork could be filed, farmers reported that loans were often less than required.[359] Voluntary agencies were found to be of some assistance in the process, but unless they were involved farmers noted that it was difficult to get any kind of loan. Many successful credit transactions related to issues of land, yet even the study's researchers had difficulty in procuring accurate landholding data. However, the flexibility of the study's methodology, as well as its focus on village level knowledge allowed for a novel solution to this problem.

Landholding data, it appears, was one of the most difficult things to be sure of, since accurate records often didn't exist or were difficult to procure. The study found that the "the best way to enquire about any villager's landholding is to generate data in the village meeting. In any Indian village, every resident knows about the landholding of every other farmer." [360] Remarks such as these are novel and important insofar as they indicate a growing desire to validate local knowledge, even when sorting out official legal matters. Although one may chalk an observation such as this up to pastoral romanticism the following quote serves to illustrate that local community knowledge is more than just a self-regulating source of community history, it can also act as a check and balance against the class interests of the rural landed elite. Gupta asserts that "at least in the case of short term and small loans where land is not a security (because small farmer loans do not require any collateral security) the need for land records should be dispensed with...there is no reason to believe that certification by the rich, who are often the non-official certification authorities, would be more accurate than by the poor [to] ensure identification of genuine borrowers. On the contrary, as some of the cases show, their involvement deters others from even trying for a loan."[361] This quote serves

[357] Hindi term for the officer in charge of taxation and revenue at the district level.
[358] *Ibid*., p.43.
[359] *Ibid*.
[360] *Ibid*,. p.44.
[361] *Ibid*., p.44.

to illustrate a common theme of local knowledge politics when it comments about the "accuracy" of the certification process. Gupta draws attention to the class dynamics of the countryside and entreats the reader to consider the difference between the validation of knowledge by one class or another. In this light, the land title requirement was more than a simple bureaucratic formality; it was also a means of validating the landlords' status in the rural hierarchy while providing this class the opportunity to intervene according to their interests.

In a section detailing reasons for land transfers the subtitle "deceit" appears. The study demonstrated that the primary cause for land transfer in a number of cases was due to deception, although it was not a significant percentage of the overall transfers. One farmer recounts how in 1962 he took out a loan for Rs 500. He went to repay the loan within his allotted year, however, the lender informed him that he had to pay back Rs. 2,000 instead. Apparently, the lender had taken the illiterate famer's signature on a blank piece of paper while issuing the original loan. He then filled in a higher principal. Although the transaction was false, it was in writing and therefore valid. The farmer was forced to sell his land to the crooked lender to pay for the balance.[362] While not all accounts of the village money lenders reflected outright thievery, the exploitative interest rates of informal loans were an important factor in many other land transfers.[363] The most common reason for land transfers was to pay off an informal loan taken from money lenders, traders, or landlords. Loans were often accompanied by a strict repayment schedule, which if not adhered to, resulted in the loss of a percentage of the borrower's land. [364] The power of the lending class is evident in such a system and a number of abuses of that power are recorded in the pages of this report. Therefore, the thought of trusting the collective memory of the village rather than the specialized knowledge of the literate lenders no longer seemed implausible. It also reinforces the class dimension of indigenous knowledge. Tangible examples such as land transfers demonstrate that different spheres of knowledge also represent different spheres of class power, and that the contradictory interests of these spheres heavily influence knowledge dynamics at the local level. In this context, the report

[362] *Ibid*., p.477.
[363] *Ibid*., p.478.
[364] *Ibid*.

suggested the need to examine the juxtaposition of indigenous historical knowledge with the sceptical documentation procedures of a rural money lending elite.

Class is more explicitly dealt with in a section of the report entitled "Land Transfer, Seasonality, and Stratification". The section presents land title statistics with specific reference to the time of year such titles are transferred and is accompanied by a collection of farmer recollections of such transfers. This innovative section allowed a new kind of farmer knowledge related to credit to surface; their relationship between seasonal ecology, land, and class. The purpose of providing the relation between the transfers and the time of years was to demonstrate that especially in the semi-arid and arid regions the timing of credit intervention is important and recommended that "financial institutions should pay greater attention to this factor."[365] Farmers' comments and land transfer data revealed that rural capital accumulation and a farmer's ability to repay loans or get new ones was heavily dependent on the time of year, and varied greatly from farmer to farmer. For example, the *rabi* and *khariff*[366] sowing times are highly important in a semi-arid or arid village, while it is much less so in an irrigated village, "the implication being that in the sixties, capital accumulation in the *khariff* season fuelled the land market...in the seventies the changes in the cropping system consequent to irrigation have influenced the seasonality and land transfers."[367] This essentially meant that land transfers were often conducted shortly after the period of greatest capital accumulation in dry regions; around time of the harvest of the *khariff* crop. With the advent of widespread irrigation during the Green Revolution, a class advantage came into play and disrupted the customary prices for crops and land. Gupta remarks that "the note on seasonality of stratification quite strikingly brings out the effect of technological change on the land market."[368] The process by which this stratification affected the land market is worth further exposition.

The farmers who could afford to invest in irrigation infrastructure were not always of the money-lending or landlord stratum, but the advantage of this class was especially exaggerated in the

[365] *Ibid*., p.472.
[366] Hindi terms referring to spring, or the dry crop season and autumn, or the monsoon crop season, respectively.
[367] *Ibid*., p.475.
[368] *Ibid*., p.66.

semi-arid and arid regions. Irrigated lands were less prone to risk and had greater flexibility regarding ecological adaptability. The irrigated farmer had the ability to control the growth of his crops independent of the natural monsoon cycles relied upon by the rain-fed farmer. Irrigated farmers could therefore manipulate the prices of his harvest by bringing it to market before the non-irrigated crops had matured and, the report revealed, he could similarly manipulate the value of his land. Gupta elaborates, by noting that "the stratification process seems to have an important relationship with ecology and endowment for it is considerably influenced by the technological interventions...It is shown how the ability of irrigated farmers to not only lease in land and lend money is more so that the land of drier farmers could be taken over through credit or tenancy transaction, but also by inflating the land prices such conditions for a dry farmer are created in which he may progressively be disposed of land."[369] Farmers also indicated that irrigated farms gained greater control of fallow lands, fodder, pastures, and grazing for livestock, as well as over previously common property. These factors become linked to the issue of credit, land and technology in Gupta's eyes, because "with the intensification in agriculture the irrigated farmers... exercise greater control over grass in their fields which earlier were available to the livestock predominant dry farmer just for the asking."[370] Here, credit and agricultural technology combines to deliver a huge class advantage to the large landowner or landlord. They serve to increase his control over the production of his farm's capital not only in terms of increased production, but also in terms of the value of his land, and the land surrounding his plot. By manipulating market prices in land and commodities the irrigated farmer concretized a class advantage and ensured rural class stratification.

This section represents an important and novel contribution of documented local knowledge, but it also highlights an important methodological contribution of the report. Unlike previous social science reports, this one coupled its inclusion of quantitative statistical data with contextually relevant qualitative data. While the Gilpatric and ICRISAT documents were filled with graphs and charts comparing consumption, tenancy, and credit statistics none were ever matched

[369] *Ibid*., p.476.
[370] *Ibid*., pp.476-77.

with the human stories which lay behind those numbers. While both represent forms of indigenous knowledge documentation, the small non-numerical details which lay behind these statistics proved essential to understanding the influential workings of class dynamics, such as seasonal advantage or land title documentation. When a balance was struck between quantitative and the qualitative data found in the testimonies of small farmers, a broader picture of rural development emerged in which the process of technological intensification exacerbated the process of rural stratification. This in turn translated into a greater class influence on markets of both crops and land and resulted in still further class advantage, and still further rural stratification.

Impoverishment in Drought Prone Regions represents the continuation of the participatory research method in agriculture which emerged from the new concept of farm systems research. It is not only a continuation, but as a review of the document has shown, it represents an advance of the research which was being conducted by the ICRISAT in village level studies. The novel methodological contributions are what make this publication especially worthy of study since they demonstrate a sincere desire to forge a research process which resembled a dynamic dialogue and which was not confined to statistical representation. This dialogue is characterized by an emphasis on knowledge not only about, but by rural inhabitants. The rich accounts of village life and struggle which fill the pages of this report provide a candid repository of rural indigenous knowledge. This record details not only local risk management strategies in drought prone regions, but also conveys the legacy of technological intervention in a traditional agricultural system as described by farmers themselves. The case studies reveal how the modern technologies of irrigation and formalized rural credit institutions represented a class advantage which excluded most small farmers from the development process, and increased rural stratification. However, just like during the Green Revolution, it is difficult to say whether such a process of stratification was not part of the overall plan of development from the beginning. In a later work, Gupta reveals that the knowledge gained by such publications as this may be mitigated in favour of industrial development policies. In a paper addressing this issue Gupta asserts that such agencies as the National Commission and Development of Backward Areas (NCDBA) and the Planning Commission "went to the extent of suggesting that

development efforts in drought prone regions should not check the migration [from villages to the city] too much lest the supply of cheap labour for large infrastructural projects elsewhere [be] checked. It is not surprising that the social discontent is increasing in some of the backward regions... on account of such a definition of developmental goals by the dominant elite".[371] In light of such developmental approaches adopted by ruling class interests at the national level, it is not surprising that rural stratification was such a prominent phenomenon. Such concentration of wealth and land would serve the interests of both the rural and national ruling classes and would have influenced the politics of knowledge in those systems such as credit and agricultural science which determined the speed at which capital could be accumulated. The revelation of farmers' frustration at the land title requirement contrasted to the village level knowledge of titles is an indication of one such knowledge biased policy.

Legacy of the "Voices from Below"

The lessons learned in this massive sociological survey of Maharastra are recounted in a number of papers Gupta published in the years to follow. The concerns they address are indicative of the social and agricultural science landscape in the mid 1980's. Gupta's promotion of a "socio-ecological paradigm" as part of a research agenda is a notable contribution. This paradigm emerges from his experience with the SDC study and is elaborated in a paper published in 1985. Here, Gupta addresses the growing regional imbalances and social tensions evident in rural development strategies.[372] Based on his previous village level surveys the paper put forward the thesis that "ecological conditions defined the range of economic activity that could be sustained in a given context."[373] This activity was further defined by a region's class structure and labour markets. It was through these primary filters that household budget surpluses or deficits manifested themselves. The

[371] Anil Gupta. "Drought, Deprivation, and Sustainable Development Why are Public Policies so Weak?" (Ahmedabad: IIM, 1991), p.1.
[372] Gupta, Anil."Socio-Ecological Paradigm for Analyzing Problems of Poor in Dry Regions". Ecodevelopment *News*, No.32-33, (March 1985), p.68.
[373] *Ibid*.

perception of risk influenced household decisions and the degree to which outside intervention, whether through credit of agricultural technology, would be accepted. These combined factors "generated a given size and rate of capital accumulation as characterising stable or unstable cash flows. In turn, these cash flows created surplus, subsistence, or deficit budget conditions...In semi-arid regions, given the wide range of environmental fluctuations, the changes generally were oriented towards a condition of high entropy."[374] In short, the socio-ecological paradigm espoused in the paper provided a conceptual research framework which implied that the milieu of economic activity in a given region was defined first by its ecological conditions in an historical social context. Furthermore, "the scale at which different classes of producers operated these enterprises depended upon the historical reserve of surpluses or deficits, access to credit, labour and product market (which are crucially interrelated), [and] risk bearing capacity."[375] Through this publication Gupta advanced a means of prioritizing agricultural research based on the interrelation between the particular ecological and social conditions of a region, rather than by advancing generalized foregone conclusions. The irrelevancies of such past nomothetic approaches were not being abandoned for a quagmire of idiography. Instead, the generation of data pertaining to local conditions was being championed in a manner which would resemble Lewontin's balance based on the prevailing influence of regional social and ecological factors.

It was noted that the dry regions were especially disadvantaged when operational programmes were replicated by state planners from different ecological regions. For instance, the train and visit (T & V) system of agricultural extension demanded the same number of village demonstrations from its village level workers per week, despite the fact that the population density is markedly reduced in the dry regions.[376] Inevitably, such services suffered as a result of not accounting for ecologically determined demographic variation.[377] Also, dry regions tended to be more risk prone in general due to weak local markets, uncertain rainfall, and the use of low value

[374] *Ibid*., p.71.
[375] Anil Gupta. "Transferring Science For Development and Diffusion of Technology: Agenda For Recasting Extension Science Research For Drylands/Rainfed Regions". (Ahmedabad: IIM, 1989), p.46.
[376] *Ibid*., p.49.
[377] *Ibid*.

crops, such as millet and oilseeds, which were particularly susceptible to pests.[378] Failure to adapt delivery mechanisms for services such as credit and technology to regional requirements had the potential to exacerbate such risks. Gupta notes that even "the design of technology will have to be reconceptualised in a socio-ecological framework."[379] It would have to become more participatory and inclusive of farmer's input so that relevant technology could be generated. Specifically, the paper points out the need to "document the traditional criteria for varietal selection in crops as well as livestock so as to integrate these organically with the breeding objectives for the future."[380] It also recounts one of the major famer contributions to the *Impoverishment in Drought Prone Regions* when it recommends the launch of "action research projects on credit linked to insurance…so as to trigger technological transition in a big way."[381]

These recommendations come partially from the village level experience of the previous study and points to one concrete example of how development projects like credit programmes can be derailed without local knowledge of the risk management strategies of the region in question. Furthermore, for the socio-ecological paradigm to be effective, common assumptions on the practices of poor farmers had to be dropped, notably, the misconception relating to poor farmer's stewardship of common property resources. Gupta insists that "it must be recognized that poor were not only better conservators of natural resources as demonstrated in our studies, but also had longer term stakes in the preservation [of resources]. The village rich who did not have to either often migrate out or graze the animals over longer distances unlike the poor, were mainly responsible for degradation of village commons."[382] Since common property resources played an important role in the social dynamics of the village, for such purposes as grazing and fuel collection, an unbiased view of the governing of such resources was demanded for effective future research.

The final paragraph of the paper appealed for the creation of a dialogue amongst that "minority of professionals who may not have been lured already by the tempting agri-business

[378] *Ibid*., p.50.
[379] *Ibid*., p.51.
[380] *Ibid*., p.52.
[381] *Ibid*,. p.53.
[382] *Ibid*., p.54.

supported, multinational corporations-dominated research support system biased towards irrigated regions. Unfortunately, the governments in developing countries relying on conceptual filters developed for irrigated regions were neither keen to define the problems of dry regions differently nor in solving them."[383] Gupta warns that failure to address the above issues will only result in more rural and regional tension. He also remains optimistic that the international concern for the problems of the poor in such regions will turn into action "before the patience of the poor runs out."[384] Allusions to class conflict aside, this quote reveals some of the frustration within India regarding biased governmental policies such as the Intensified Agricultural District Programme, which pandered to previously advantaged and low risk areas. The optimism regarding international concern is also indicative of the climate of the 80's which saw increases in the number of donor agencies funding developmental projects especially directed to marginal segments of the population.[385] Finally, the "minority" of professionals who Gupta foresaw starting a dialogue relates the dismal perception of alternative development perspectives held by the mainstream of formal Indian scientific research institutions at this time.

In another publication to emerge from the data collected in the 1983 study Gupta addresses the established research agenda with reference to the recently articulated socio-ecological paradigm. After review of a set of important studies done by the Center for Management in Agriculture over the last decade it was found that there was a "historical bias" in national research policy in favour of irrigated regions.[386] This bias encouraged a neglect of the rainfed dryland regions at the national level, so that when state attention again became focused on these areas, the research methodologies to be mobilized were the same ones which were previously used in the irrigated areas. Warning against idiography, Gupta asserts that adherence to the socio-ecological perspective without falling into the trap of "ecological determinism" was one means of overcoming such research hindrances.[387] Compounding the problem though, it was found that the dryland research centers were often used

[383] *Ibid*., p.53.
[384] *Ibid*., p.55.
[385] Pushpa Sundar. *Foreign Aid to Indian NGOs: Problem or Solution.* (New Delhi: Routledge,2010), p.116.
[386] Anil Gupta. "Agenda for Research in Dry Regions: Socio- ecological Perspective- IIM Working Paper No.537".(Ahmedabad: IIM, 1984), p.1.
[387] *Ibid*., p.5.

for "punishment posting" for scientists.[388] This was alluded to in data from a 1976 survey which found that many of the scientists who received posts at arid or semi-arid institutions were either finishing a probationary period or were being "punished", and that these individuals very often had "transient interests/stakes" in research priorities.[389] Such individual motivational concerns built into the structure of the research network were less easily remedied and provided further reason for the government to adequately address policy for marginal agricultural regions.

Agricultural research was also addressed with specific reference to the designing and delivery of technology. Crucially this study articulates the need to document traditional agricultural techniques, as well as the need to include social science research at the "ex-Ante stage of setting up technological priorities." [390] This echoes and elaborates on the farm systems research model espoused by the ICRISAT and is novel in its recommendation to document not only farmer needs or problems, but also practical technical farmer knowledge. Such inclusions indicate the documentation of region specific farmer needs was becoming increasingly sophisticated. For example, it is recommended in the paper that the link between dryland rural cottage industries and agriculture be looked at more closely by planning officials especially with reference to livestock. It was noted that the high level of income disparity in the countryside was accentuated due to the "exploitative role of big farmer-trader-lender in particular years of crop failure and livestock epidemics."[391] Instances of drought caused massive livestock "disposal", as well as spikes in informal interest rates. This was illustrated in the Deccan riots, which were triggered following drastic spikes in informal loan interest rates after a severe drought in 1979-80.[392] The paper recommends that a "mutually reinforcing policy" should be put forward which would be informed by an in-depth study of the "organic link that existed between crop-craft labour and livestock."[393] The recognition of the need for an interdisciplinary systems approach to agricultural research is a theme which emerges a number of times in this and other papers to follow the 1983 dryland study. Such village level data demonstrated

[388] *Ibid*., p.4.
[389] *Ibid*.
[390] *Ibid*., p.6.
[391] *Ibid*,. p.5.
[392] *Ibid*., p.6.
[393] *Ibid*., p.7.

the complexity and interconnectivity of village economic activity and increased the demand for recognition of regional variation based on socio-ecological conditions and the knowledge which was local to those conditions. The importance of understanding the social, economic, and ecological dynamics of the dryland village was becoming increasingly clear after such instances as the Deccan violence.

Farm Systems Research: Innovations and Limitations

In 1985 the Bangladesh Agricultural Research Institute (BARI) invited Gupta to apply his newly developed socio-ecological paradigm in the field. This export of Gupta's evolving methodology yields a wealth of insight into one of the first efforts to combine participatory research techniques with a sustained on-farm agricultural development project. Analysis of a collection of unique BARI primary sources from this period makes further exploration of the BARI studies an important contribution to this study's investigation of the history of indigenous knowledge diffusion. Furthermore, Gupta's personal field notes from the project were transcribed for the first time for this thesis, providing illuminating insights into an insider's personal experience facilitating and witnessing the interaction between formal scientific research and indigenous knowledge.

The BARI chose Gupta after its director visited the Indian Institute of Management for an agricultural conference, where he was exposed to the socio-ecological framework developed by Gupta.[394] He was personally invited to explore the possibility of integrating this framework into an upcoming BARI project. The Bangladeshi Secretary of Agriculture and Forests lent his personal support to the pioneering of a new research methodology which reflected the concerns of farmers and "respected the farmers as highly competent professionals."[395] They decided to elect Gupta for their project over members of the extension division of the IARI because they wanted to "make their scientists learn the art of developing technology for the poor people" and, except for Gupta, there was

[394] Anil Gupta, "Generating Ecology and Class Specific Research Priorities; Socio-ecological Perspective on FSR at BARI" (Farming Systems Research Conference, Kansas, USA, Oct 5-7, 1986). p.2.
[395] *Ibid*.

"no prior experience in the world at the time for developing technologies for the poor by using their own knowledge."[396] A participatory approach to research in India was still in its infantile stages and the IARI lagged behind the innovative and results oriented approach pioneered by Gupta. BARI sought innovations in their village level research and experiential guidance to aid the efforts of their On Farm Research Division (OFRD). An annotated bibliography of the BARI OFRD library in 1986 indicates just how experimental this new division and the very concept of FSR was, as well as what limited resources informed their venture. A handful of FSR specific papers and books were listed in the bibliography and none predated 1984. Two of the handful were authored by Anil Gupta and his "Socio-Ecological Paradigm" piece was among them.[397]

The need to further develop FSR by more effectively synchronising research agendas with the needs of farmers is evident in an address given by Bangladesh's Secretary of Agriculture and Forests, A.M Anisuzzaman, at a National symposium on Agriculture Research in 1983. The address, entitled, "Ten Years of Agricultural Research in Bangladesh" reflects on the fact that "far too many of our research scientists are research station oriented. They regard the famer as illiterate and, therefore, ignorant."[398] He asks rhetorically what has been done to persuade scientists otherwise or if the scientific community has even recognized this as a problem. His final comment criticises the lack of encouragement for scientists to "get into farmers' fields to conduct farming systems research, and to take farmers needs, constraints and resources as the starting point for their research."[399] This final comment points to the large gap which existed between theory and praxis in the FSR discipline. In the early 1980's FSR was still a relatively new concept and the Secretary's speech alludes to the fact that its inclusion in BARI policy is far different from its concrete incorporation into the ground level activities of the Institute. It also differed greatly from the top-down philosophy of India's Agriculture Minister, Subramaniam, in 1966.

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[396] Interview with Anil Gupta March 12, 2011.
[397] OFRD, BARI. "Library Bulletin # 1, July, 10, 1986". Joydepur: BARI, 1986.
[398] A.M. Anisuzzaman. "Ten years of Agricultural Research in Bangladesh" (Proceedings of the National Symposium on Agricultural Research, BARC, Dahka, 22-23 December, 1895), p.3.
[399] *Ibid*.

Alternative approaches were sought to remedy this situation. Beginning in 1985, Gupta, who maintained a professional interest in risk prone regions, was asked to switch his focus from the drought prone regions of India's Western States, to the flood prone regions of the nation which was straddled by India's far Eastern states.[400] He collaborated with other social science researchers of BARI's On Farm Research Division (OFDR) in order to further incorporate his socio-ecological work with the FSR already being done. Selections from his personal notebooks chronicle the process which guided this experimental new branch of research and reveal unique insights into the interaction between formal scientific and informal village processes of knowledge production. As an outside consultant and workshop organizer Gupta contributed to the methodological framework of the BARI project. Essentially the project involved conducting test trials of BARI technologies, such as HYV rice, on a number of small farms. This was to be done with the consent and cooperation of the local farmers on whose land the trials were to be conducted. The project involved the interdisciplinary collaboration between numerous BARI divisions, including plant breeding scientists, FSR scientists, agricultural economists, extension agents, and the ORFD, a division which was already highly heterogeneous. [401]

Gupta`s preparatory notes for the project provide insight into the process of determining the OFRD scientists' research objectives. Two important inclusions were an emphasis on the documentation of farmer's reactions to the on-farm research process and the "selection of agronomic and innovative practices of farmers".[402] This was to be done as OFRD scientists worked in tandem with farmers to conduct test trials of new varieties and agronomic techniques developed at the BARI. This had the double purpose of eliminating artificially enhanced growing conditions, and therefore artificial yield data, which the well equipped centers exhibited, as well as developing rapport and feedback from farmers.[403] Feedback from farmers was critical, but equally important was feedback from the ORFD staff to the scientists still working at the BARI center and in labs. In fact Gupta records that "all sides/conduits may serve a role in identifying the match and mismatch between the ongoing

[400] Interview with Anil Gupta March 12, 2011.
[401] Gupta, Anil. Field Notebook # 3, January, 21st, 1986. p.1.
[402] Gupta, Anil. Field Notebook #1, 1985-1986. p.2.
[403] Gupta, Anil. Field Notebooks #4, February, 16th, 1986. p.13.

research plan, such as cropping and compost field trials, with the on station research program."[404] The test trials were recommended to be flexible according to the conditions in the farmers' fields. Also, contingency plans were conceived which offered alternative cropping options in the event of adverse conditions as well as serving as case studies for future risk management strategies.[405] The inclusion of the "contingency" concept was a novel addition over the IARI test trials of HYVs, and it was indicative of the new farmer sensitive research approaches being undertaken in the 1980's as well as advances in knowledge of risk management.

Gupta's notebooks reveal a number of other concerns which were unique to the participatory research approach being pioneered by the ORFD. Some of the most vexing questions faced by the social science staff related to the issue of feedback, not *from* farmers, but *to* farmers. For example, researchers were asked, "what should we feedback to farmers? what are our own weaknesses? Should we feed back these findings [relating to researcher weaknesses]?"[406] The desire to initiate an open, informed, and honest dialogue with farmers was obviously paramount, but no precedent existed for such questions and they would have to be felt out as the project unfolded. Another notebook relating case study criteria probes the method of interaction with farmers. As the project unfolded issues emerged such as "how to ask questions?", "how many questions to ask and for how long to ask them?", "which question to ask first?","how to build checks into the questionnaire avoiding redundancy?"[407] The case study surveys were to be unique data sets insofar as social and scientific data were collected simultaneously. This was different from the 1970s ICRISAT village level studies which focused on one or the other.

Other unique data was collected in this project which enhanced the ability of researchers to understand the rural decision-making process. In a number of instances the homesteads of farmers were mapped out to determine what could be inferred from an analysis of the spatial relations which

[404] Gupta, Notebook #1. p.9.
[405] *Ibid*., p.4.
[406] *Ibid*., p.11.
[407] Gupta, Notebook #2. p.1.

existed on the farm.[408] The mapping process revealed localized problems which would have been otherwise overlooked. One instance related a farmer who could not use his cow dung for fertilizer since he had no space to dry the dung cakes at his homestead. Realizing the spatial constraints on the farmer it was decided to investigate whether or not the BARI could develop a technique for drying the dung cakes in a spatially restricted environment, thereby increasing farmer`s access to cheap organic fertilizer.[409]

Other items to be covered in the surveys were "economic endowments" such as land, livestock, trees, ponds, implements; "land use" including topography, fertilizer use, tree species and age range, use of non-agricultural products from the land ie. tree bark, fruit, leaves, wood for fuel, vegetables; "current status of technology", meaning the documentation of the range of on farm agronomic practices, input use, crop yield, crop by-products; "access" which included credit, labour, and inputs; "consumption"; "energy"; "remittances"; social/cultural"; and "risk".[410] The emerging emphasis on complexity through the inclusion of such qualitative data is concurrent with the FSR approach and is evident in the broad categories included in these field surveys. There are hardly any aspects of rural life which are left out of such a sweeping collection of data, but for present purposes the inclusion of "current status of technology" demonstrates a qualitative landmark in the diffusion of indigenous knowledge related to agriculture. This category is the first to explicitly request documentation of traditional agrarian techniques.

To ensure the accuracy of such documentation the survey was to be conducted "prior to any particular outside interference/experiments."[411] The survey was to be "historic" in nature and having the capacity to "build up the diversity of technical practices" available to research centers.[412] This was a crucial point for the surveys to capture since it served the double purpose of expanding the tool set available on-station, as well as revealing a wealth of knowledge regarding the decision making process on the farm. Until this process was better understood, new technology would

[408] Interview with Anil Gupta March 12, 2011.
[409] Gupta, Notebook #4. P.19.
[410] Gupta, Notebook#2. pp.3-4.
[411] Ibid,. p.5.
[412] *Ibid*., p.7.

continue to be irrelevant. Gupta remarks that "until we know what is the requirement of farms under a certain set of conditions and how he avoids risk, on-station scientists cannot generate appropriate varieties."[413]In some of the first direct comments to link plant breeding, rather than only ag-economy or agronomy, with indigenous knowledge, it is revealed that not only was IK important for the diversity of innovative practices it contained, but it also had the potential to clue researchers into the varietal traits which were desired by farmers. In this way the diffusion of indigenous knowledge was able to hasten the effective diffusion of formal scientific knowledge in the form of agricultural technology which was relevant to the localized risk management strategies of farmers.

The Ford Foundation partially sponsored the OFRD mission which was generously contributing to the development of FSR across South East Asia. Documents from the Foundation indicate that donations amounting to $35,000 would be allocated over a period of 18 months beginning in Jan 1986 in support of a various FSR related projects, including the BARI OFRD project and a workshop held at the Food and Agriculture Organization of the UN in Rome.[414] The conference was designed to bridge the gap between national agricultural research centers and the international agricultural research centers (IARCs) of the CGIAR, who were major recipients of Ford Foundation funding. The Ford staffer notes that "the foundation has initiated projects to help expose researchers and planners to integrated agro-ecosystems concepts and methods. Interdisciplinary expertise...has been developed through support to facilities of agricultural or environmental studies programs at such universities as Kohn Kaen, [and] Chaing Mai."[415] The document also indicated that grants had been made to five agriculture research Institutes in Eastern India for the purpose of "strengthening skills in FSR. Further support is planned to provide technical assistance and training in field-oriented research methodologies".[416] Documents such as this indicate that developmental aid coming from the large Foundations still played a critical role in linking national and international research in the late

[413] Gupta, Notebook#3. p.1.
[414] Robert Lenton and James Butcher to William Carmicheal."Ford Foundation Inter Office Memorandum". December. 3, 1985. p.1.
[415] *Ibid*.,p.2.
[416] *Ibid*.,p.1.

80's. In particular, the contributions of the Ford Foundation helped to increase the legitimacy and further the development of FSR and on-farm research.

The OFRD project began in January of 1986 near the city of Joydepur near BARI headquarters. Several months of field trials testing various agronomic techniques and new varieties of seed, which included HYV rice, were punctuated by a series of training workshops for the field staff.[417] Gupta spent time in the villages working with the research staff as well as organizing these workshops. One such workshop held in July, 1986 demonstrates the process by which the discipline of FSR was developed at the level of praxis. The internally circulated document to emerge from the workshop is indicative of some of the problems associated with the new methodology of FSR and points to the larger issues of indigenous knowledge documentation. For example, the report notes that "in appraising new technology (new crop varieties) farmers' reactions were not ascertained and reported. The data on by-products and their uses should also be presented."[418] The systems element is evident in this quote with its emphasis not only on farmers' reactions, but also on the farmers' use of the by-products of the newly introduced crops. This indicates a concern for more than just the yield and growth rate of a new variety, but also whether or not its stock and chaff, which would be turned into fodder, was satisfactory to the farmers' animals. This was an important factor since income spent on animal feed external to the farm could increase the household deficit. To better understand the systems element of farm operations researchers were told that "while evaluating farmers' practices, sweeping generalizations should be avoided and proper attention to location specific factors should be provided....since there is a large diversity of practices and yields among different farmers within a small agro-ecological region".[419] One example from the case studies illustrates the motivation behind understanding local logic. While farmers in one area performed only one or two ploughings per year, others not far away did as many as ten. While the scientists recorded this phenomenon, they did not ask the important question, "why?". It was recommended that the researchers return to the famers who gave them this information to find out the logic which

[417] Gupta. Notebook #4. p.1.
[418] *Ibid*., p.10.
[419] *Ibid*., p.11.

underlay such a great divergence of practices.[420] Examples such as this illustrate the new level of appreciation emerging for farmer knowledge since novel farmer practices were no longer dismissed as ignorant or backward, but were rather approached from the point of view that each practice was potentially indicative of a time tested survival mechanism and responsive to local ecology.

Gupta's notebooks contain his personal experiences facilitating these workshops as well as notes recording the individual concerns of the BARI researchers. Among these concerns was the lack of FSR information available to staff and a lack of uniform methodology. Apparently, the handful of FSR publications held at the OFRD library was not adequate to uniformly inform the field staff or synchronize research practices. One researcher recommended that the BARI "shift all sites into FSR approaches".[421] Others commented that "we are not working with all aspects of FSR."[422] An example of the difficulty of the interdisciplinary approach demanded by FSR is apparent in this and other comments from the field staff which asked "should we work with livestock when there are no livestock specialists on hand?"[423] The highly segregated agricultural education process is alluded to in such comments as well as the difficulty in general of the scientist/farm system interaction. The field researcher had only the minor preparatory workshops to rely on for the preparation of the interaction with farmers and most had no social science training. Excluding the agricultural economists, most were not social scientists and were poorly equipped to make useful observations of a social nature. In fact, even in the On Farm Research Division only two full time staff did their PhDs in on-farm research. Apparently there was a problem attracting "good students" to this division over programs focused on "basic research".[424]

Class issues further complicated the social science portion of the on-farm projects. First, scientists were asked to note the correlation between economic status, land size, and cropping pattern for variation. FSR scientists were also asked to henceforward discuss the research program

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[420] *Ibid*.
[421] Gupta, Notebook#3. p.7.
[422] *Ibid*.
[423] *Ibid*.
[424] Gupta, Anil. Field Notebook # 6, 1986. p.10.

with the rich and poor farmers separately.[425] A passage from Gupta's notebook from the workshop reinforces this point when it records a researcher's concern that they needed "separate farmer meetings for different sizes, as big farmers dominate small farmers in these settings".[426] The categorization of farmers in this way was a problem for some researchers who felt that some uniform standard had to be established. The workshop attendee concluded that such a distinction should be made according to the "basis of resources per capita and food sufficiency."[427] It is interesting to note the difference between this classification, which uses the criteria "resources", and "food sufficiency", and the net income criteria used by Gilpatric.

Individual meetings were also to be held with farmers and steps were to be taken which ensured no class bias in such meetings. It was important that both extremes of the rural class spectrum, including landlords and marginal farmers, attend such meetings. This point is mentioned by numerous researchers at multiple workshops.[428] The problematic influence wielded by the landed elite was a reoccurring theme in Gupta's notebooks. For instance, it was recorded that some tenants had to obtain permission from their landlord before participating in the test trial of a certain HYV variety of rice named Br-11. In fact any fluctuation in their crop rotation of traditional varieties of *aus* and *aman* rice had to be cleared with the tenant's landlord.[429] Such restrictions on cropping patterns reveal the limitations of the production of local knowledge since such knowledge often depended on the farmers' interaction with his environment and his superiors. A limited field ecology imposed by the rural class structure limited a farmer's ability to innovate, since it limited the resources available to do so. Other economic limitations were imposed on the tenants which were indicative of the complicated class milieu of the 1980's Bangladesh countryside. From the accounts of farmers in Gupta's notebooks it is apparent that sharecropping still played a large role in the villages' semi-feudal economy. For a number of tenants, all the year's straw had to be taken to the landlord's

[425] *Ibid*., p.14.
[426] Gupta. Notebook#3. p.7.
[427] *Ibid*.
[428] *Ibid*., p.8, & Gupta. Notebook#6. p.31.
[429] Gupta. Notebook#5. p.9.

residence, even when the majority of landlords were absentee.[430] In some instances, all homestead vegetables had to be taken to the landlord as well.[431] So in addition to limitations placed on cropping pattern, the farmer accounts reveal that both straw, which was usually used as fodder, and homestead vegetables were subject to class interventions. The aspect of sharecropping whereby landlords controlled various spheres of production on their rented land ensured that the amount of livestock, and livestock related knowledge, would also be limited, since purchasing external feed inputs would often be too costly. It also ensured that women's ability to generate income would have been diminished, since they were almost exclusively responsible for the vegetable gardens grown on a tenant's homestead.

To return to the workshops, it was concluded by the research staff that each scientist was to meet with the farmer on whose land they were conducting test trials of new varieties at several stages of the research process. Farmer/scientists interaction was to take place before planning the experiment, before laying out the trial to convey the objectives of the experiment, and at the "vegetative stage" in order to look at the influence of disease, pests, weeds, etc.[432] Despite the official line recorded in the BARI documents Gupta's notebooks relate how this protocol was not always followed or if it was then it was done either in haste or ineffectively.[433] One farmer participating in the test trials who was not properly briefed regarding the on-farm process asked the BARI staff "what will you give us?"[434] Such basic information was something which should have been communicated to the farmer long before the test trial had even begun according to the OFRD's protocol.[435] The farmer's comment causes Gupta to reflect if researchers had accurately communicated the "purpose of the trial to the farmers"[436], indicating the tendency of poor reciprocation on the formal science side of the on-farm interaction.

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[430] Gupta. Notebooks#4. p.12.
[431] Gupta. Notebook#5. p.9.
[432] *Ibid*,. p.13.
[433] BARI. "Objectives of FSR Site in Bagherpara, Jessore, Sept, 17, 1986" Joydepur**:** BARI, 1986. p.2.
[434] Gupta. Notebooks#4. p.18.
[435] BARI. "Objectives". p.2.
[436] Gupta. Notebook#4. p.1.

Nonetheless, there was a consistent imperative for reciprocal communication from the management staff of the project. In addition to accurately relaying the purpose of the trials researchers were also asked to document farmers' technical knowledge.[437] In the process of the on-farm meetings which did take place "if there are any extraordinary circumstances the scientists should urgently seek the farmers' reaction and study the relevant coping strategies".[438] This emphasis on farmer technical knowledge related to agriculture is a novel inclusion of the FSR documents studied so far. Gupta records a number of his personal encounters with novel practices in a notebook section entitled "Issues Related to Farmers' Innovative Practices"[439]. Here, a number of novel pest management, moisture conservation techniques and yield increase strategies are recorded. Intercropping patterns were noted for effectiveness of insect resistance and green manuring techniques were also included.[440] Two of the more intriguing techniques were the practice of inserting opium into a bottlegourd stem to increase yield, and injecting papaya with a cholera vaccination to quicken flowering.[441] Dozens more specific examples were listed and it was "expected that some of these practices would be taken up for scientific testing in the research program of 1986-87. Each site must have at least 2-3 experiment observation trials in each season to discover the science of peasant innovations."[442] The designation of local innovation as a "science" is further indication of the legitimization of indigenous knowledge. In order to ensure that this process of discovery continued "the process of dialogue with poor farmers must be institutionalized in such a manner that every scientist and field staff should continue this activity and report the insights obtained and use made thereof...Also the case study was not an end but a means to convey the need for learning from below."[443]

This need to "learn from below" was not always an easy task for the OFRD staff. Another document commenting on the data collection methods of the FSR sites relates one example of the

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[437] BARI Internal Memorandum. "Comments on FSR Review Reports: to scientists from BARI and BARC" (Joydepur: BARI, 1986) , p.1.
[438] Gupta. Notebook#4. p.13.
[439] *Ibid*.
[440] Anil Gutpa. Notebook#7, 1986-87. p.17.
[441] *Ibid*.
[442] *Ibid*.
[443] *Ibid*., p.18.

power of indigenous knowledge and the dynamics which influenced its diffusion. In a document entitled "Comments on the Data Collection and Analysis at FSR Site Godagiri" an instance of knowledge hoarding by one landless peasant is recorded. This individual who rented land had conducted his own "experiments" related a screening process used in rice breeding, "which unfortunately the scientist did not care to look into."[444] The screening process involved the selection of superior strains of traditional rice varieties which he refused to sell to other farmers. Many locals had apparently approached the man to buy seed from him, but he refused to share his seed with either them or the BARI staff, reasoning that he would be able to get a higher price for his heritage crop if he were its sole proprietor.[445] This example from the case studies demonstrates the two-fold challenge of indigenous knowledge dissemination. The first relates to the observational capacity of the researcher who did not appreciate or record the criteria used by the farmer in the seed screening process. The second relates to the income earning potential manifested by a monopoly on innovative knowledge or an innovative technology, in this case, the heritage seed variety. The biopiracy of later neoliberal policies and corporations protected by intellectual property rights would make this issue more poignant in the years to come, even as this study insists that we consider the role of local farmers and indigenous knowledge in how market value is assigned to these seeds.

The power dynamics of knowledge and the desire to "learn from below" are further explored in the gender specific component of the project. A document based on the preliminary field investigations of a number of women researchers was prepared in part with Gupta. Entitled, "Unheard Voices: Women and the Homestead Utilisation System" the extent of the inclusivity of the FSR methodology is made apparent. The purpose of this aspect was to determine "to what extent the land use is influenced by ecological, class, and gender specific issues...to disentangle the contribution of different forces of production."[446] Regarding gender specifically, the document is unique in its respect for the knowledge of rural women insofar as it sought to "understand the role of rural

[444] BARI internal memorandum "Comments on the data collection and analysis at FSR site Godagiri". (Joydepur: BARI, 1986) p.2.
[445] *Ibid*.
[446] Zainul Abedin, Nadira Begum , Dilruba Islam, Anil Gutpa, & Roushan Ara. "Unheard Voices: Women and the Homestead Utlization System". (Paper presented in the Workshop on "Women in Agriculture" held at Bangladesh Academy for Rural Development, Comilla, 24-25th of March, 1986). p.1.

women as 'scientists'-who experiment, analyze and innovate different technological options, often oblivious of the real science underlying these innovations."[447] The data related to homestead land usage as opposed to field land usage, which in itself was a markedly gendered distinction. The decision regarding which crops to bring to market was often made by men, while the varieties of vegetables grown around the home tended to be chosen either by women, or the landlords' sharecropping arrangements.[448] The need to include research on homestead land usage came from the need to extend the FSR approach to more than just the dominant cereal crops and livestock, but also to include the income generating potential of homestead vegetable gardens. Furthermore, the inclusion of women's perspectives was thought necessary because "most scientists...tend to believe that the decisions conveyed by the male head of the household were representative of the consensus within the household, thus the bias in most social science investigations towards contacting only the male respondents during the surveys."[449] This point emphasises the consequences of the lack of female input in the previous rural sociological surveys done by either Gilpatric or the ICRISAT, and demonstrates the importance in the continuity between this project and the gender distinction first made in Gupta's 1983 report.

In addition to the novel recruitment of female researchers to work with women on rural homesteads an emphasis was placed on the dynamics of land use through the novel element of mapping. When discussing the limitations of FSR research at the time the document notes that "we did not even have a map of a homestead wherein the locational choices of vegetable crop and tree species mix, land use for settlements and shed for livestock, poultry birds, etc, were described"[450] This "locational" element is further indication of how spatial relations data could increase the relevance of social science work related to FSR. The point is reinforced as the document's annexure explicitly articulates four dimensions of Gupta's socio-ecological framework. Along with seasonal, sectoral, and sex/gender, dimensions, the spatial aspect of the framework is considered.[451] The study

[447] *Ibid*.
[448] Gupta. Notebook#5. p.9.
[449] Abedin. "Unheard Voices". p.2.
[450] *Ibid*., p.3.
[451] *Ibid*., p.9.

of homestead utilization therefore served to illuminate "the historical process through which the current state of resource use has been achieved by different classes...in various ecological contexts...for whom the homestead is the major or perhaps the only source of income after their own labour."[452] While class is not an explicit category of the socio-ecological paradigm, it is noted to be a determining factor in the sectoral dimension and the paper makes known that "just as men and women's priorities may differ, the priorities of rich and poor may differ".[453] Gupta's paradigm, the author notes, would help in determining the key questions to be asked in further homestead studies. Examples of the specific impact of the paradigm are provided by the author in the determining of such research priorities as the differentiation of vegetable varieties between rich and poor homesteads, the preferred characteristics in the selection of homestead tree varieties over generations, and the spatial relationships which existed between tree species, vegetables, huts, and barns. Other examples related to the decision making process which took place within the homestead and "to what extent decisions about vegetables are taken by the women as against...men" and "How do we distinguish the choices of mother-in-law/daughter in law in a homestead within the female dominated decisions."[454]

Above all, the homestead component of the ORFD project was to be considered "interactive, participative, and iterative".[455] The document's case study annexure articulates some of the ways in which this was to take place. Again there is an emphasis on rapport and respecting local social dynamics. In a section of the case studies entitled "Some Do's and Don'ts" a number of basic ground rules were established for researcher/homesteader interaction. Examples of the rapport building process are implied in this list in such inclusions as "do not try to teach/preach to them on any technical or social aspects...do not discuss income and expenditure related issues in the first few meetings...do not change the topic abruptly just because you want to complete your task...do not offer false hope of any kind of material aid."[456] Rapport was further ensured by compensating the

[452] *Ibid*., annexure a), p.1.
[453] *Ibid*., p.9.
[454] *Ibid*., p.3.
[455] *Ibid*., annexure a) p.1.
[456] *Ibid*., annexure c) p.3.

homesteader for their time if they had to forgo waged labour due to the survey.[457] To enhance social interaction the on-farm researchers were asked to remember that "much depends upon what you think are the strengths of the poor. They may be illiterate and resourceless but they are very rich in some of the skills, insights and ideas which have helped them survive so far. It is possible that these ideas need improvement. It is also possible that some people have already innovated the improvements. We must pay due respect to their skills and stamina."[458] Such quotes reveal the qualitative shift evident in the past two decades of development methodologies. The qualitative nature of this data collection is further evidenced by an excerpt from one of the on-farm questionnaires found in the third appendix. The issues of class and gender specifically reveal the desire and the need to make rural development an inclusive project which was facilitated by unbiased researchers and guided by village level input.

The results of the OFRD FSR research are conveyed in a number of papers to emerge from the project. In a document written by the workshop coordinators, including Anil Gupta, to the scientists of BARI, suggestions were made to improve the design, implementation, monitoring, and evaluation of future on-farm trials.[459] The institutionalization of feedback mechanisms for farmers was a crucial suggestion. It was also suggested that participant scientists themselves take part in the critical re-examination of the OFRD. Reminiscent of the 1983 study, internal criticism and self reflection were again encouraged.[460] Other documents pointed to the need for BARI to embrace research on the traditional practice of intercropping as a means of insurance against crop failure on small farms, in addition to the fact that such practices can increase farm income, improve resilience to disease, pest, and adverse climatic conditions.[461] Furthermore, the on-farm experience resulted in such new approaches to agricultural research as the integration of livestock, agro-forestry, and

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[457] *Ibid*.
[458] *Ibid*., annexure c) p.4.
[459] BARI internal memorandum. "Comments on FSR Review Reports: to scientists from BARI" (Joydepur: BARI, 1986.), p.1.
[460] *Ibid*.
[461] BARI."Present Position and Future Needs of Dryland Crop Production in Bangladesh – paper presented at the Technical Discussion Meeting on Dryland Agriculture held at the BARC, Aug 11, 1986" (Joydepur: BARI, 1986.) p.11.

fishery departments, the development of manually operated tools and implements, and further analysis of the social constraints acting on farming practices.[462]

The diffusion of IK and its related methodologies was further boosted due to the international attention the project received. This is evidenced in a paper prepared by Gupta for a FSR conference in Kansas, USA, in October of 1986. In the paper Gupta articulates a number of key lessons to be drawn from the precedent set by the OFRD in Bangladesh as well as the methodological miles covered in the past 20 years. He notes that while "the need for generating location specific technology has now been well established...less clear is the issue of generating technologies that are specifically suitable for disadvantaged people."[463] He continues on this thread to dispel common assumptions hindering the proliferation of a pragmatic FSR methodology. He points out that the "evolution of the farming systems research perspective is justified by some because it helps in giving greater attention to farmers' needs compared to the preconceptions of researchers...We argue that such claims for the given methodology are highly farfetched."[464] This is due to the fact that the prevailing attitudes still viewed FSR as a "lab to land" approach which still implied "linearity between the step of technology generation at a station...and the step of its extrapolation to larger areas".[465] Here, Gupta critiques the implementation of FSR as a continuance of the unidirectional model of technology development and transfer under a different name. He goes on to illustrate why the OFRD project in Bangladesh and its inclusion of a socio-ecological perspective differs from this enduring scientific reductionism. The project took steps to ensure that the FSR was not "ahistorical" or resembling a "lab to land approach"[466] insofar as it remained sensitive to the social development of the region and tried to allow the land to inform the lab. True to its rejection of nomothetism the methodology employed was not to be viewed as "holistic enough to encompass the interests of all classes equally" or as a "technique with universal applications".[467] Furthermore, illusions should be shed "that FSR, if genuinely participative, can be pursued in existing bureaucratic organizational

[462] *Ibid*,. p.12.
[463] Gupta, "Generating", p.1.
[464] *Ibid*.
[465] *Ibid*.
[466] *Ibid*,. p.4.
[467] *Ibid*.

culture; [or] that FSR is really the on-farm testing and adaptation of on-station technology." [468] Above all it should not be viewed as "two-way communication with one-way power".[469] Instead Gupta argues that the success of the on-farm research provides evidence "allowing poor farmers and landless labourers to use their power as users of technology to influence the design of experiments."[470] Application of this concept must be coupled with an institutional attitude of mutual accountability which standardizes "a system of two-way communication and two way power".[471] Specifically, this reciprocal power dynamic would ensure that farmers:

> in addition to providing information to researchers on the results of technological innovations, should also have the power to; a) monitor the researchers, b) change the priorities of research; and c) influence the on-station research agenda. Accountability of field scientists towards rural people cannot be achieved unless senior and headquarters scientists become accountable to junior scientists. This second level of accountability results from an administrative atmosphere which encourages questioning and creativity and a recognition that status in the organization is not always correlated with the possession of relevant knowledge and skills.[472]

The power dynamics influencing the diffusion of indigenous knowledge emerge from Gutpa's analysis as a complicated and institutionalized system. Not only was local knowledge being limited in its diffusion from the farm due to lack of accountability, but also in its diffusion from lower ranking research staff. Further complications arose from the methodological short-sightedness enmeshed in the assumptions of scientists who were already engaged in FSR. So, even as the diffusion of indigenous knowledge became common scientific capital, lingering assumptions and institutional hindrances ensured that an equally reciprocal process of knowledge exchange was still to be desired, but increasingly possible. Perhaps, as Levins argues, the final limitation is the "systems" element itself. Levins advocates for advancement beyond a systems approach which he asserts still bounds the subject by emphasizing certain relational aspects and neglecting others. In other words, a "systems approach", while emphasising the importance of interactions still placed boundaries on the subject, particularly in the way in which problems could be framed. For Levins, a sufficiently

[468] *Ibid*.
[469] *Ibid*.
[470] *Ibid*.
[471] *Ibid*.
[472] *Ibid*., p.6.

dialectical approach on the other hand would open further still the range of influential interactions capable of study, while being able to reformulate the problems concerned from multiple, open ended, and even contradictory perspectives.[473] Gupta, while not himself using the term "dialectic", echoes these sentiments while reflecting on classical models of problem solving insofar as the "inherent contradiction in such an approach to research always is that when one defines the problem, one also defines one's role as a problem solver."[474] For him, open ended models held the most promise since his own focus progressively changed from a "'problem solving' to a 'solution augmenting' approach".[475]

[473] Levins, "Dialectics", p.18.
[474] Gupta. "Internal Resource Management" p.2.
[475] *Ibid*.

Conclusion:

When asked what the major impact of the Bangladesh project had been on his personal development, Gupta replied "in one line...the Honey Bee was born of that event."[476] This is a reference to the founding of the Honey Bee Network in 1987. This NGO remains active today and is dedicated to the scouting and documentation of innovative indigenous knowledge. It has since expanded to include four support organizations and today remains a global leader in IK work, boasting an IK database of over 100,000 innovations.[477] Gupta felt compelled to found the organization because despite the international attention his post-BARI publications received and his substantial project salary, "none of the income went back to people about whom I wrote".[478]

Not all those who engaged in agricultural development were so acutely aware of the politics of knowledge involved in agricultural development. In strikingly prophetic comments, Alan Hume sardonically warns of the powers of non-indigenous interference when he pointed out in 1879 that "philanthropic manufacturers of agricultural machines, introducers of new forage plants, patentees of improved cattle food and the like, overcome by the woes of the Indian *ryot*, are perpetually dinning into the ears of the authorities...their unselfish anxiety to regenerate the country by supplying it with their wares on a large scale."[479] The class biased and nomothetic contradictions embedded in social and natural sciences supported the top-down approach to technology transfer foreshadowed by Hume. In a dialectical process, the antagonisms caused by such contradictions, such as inappropriate technological development and rural stratification, compelled the agricultural research community to rethink its original methodological assumptions. These assumptions within the social sciences initially championed the collection of "objective" quantitative data. However, the complex and problematic social conditions which emerged from the GR ensured that qualitative shifts would occur in the methods of data collection as well as the kinds of data collected. Furthermore, technology transfer would eventually be recognized as an interactive social process which demanded

[476] Interview with Anil Gupta, March 12, 2011.
[477] "About Us", Honey Bee Network, 2011. http://www.sristi.org/hbnew/index.php
[478] *Ibid*.
[479] Hume. *Agriculture*. p.2.

qualitative input from the farmers themselves. At this stage it can be said that dialectics became a "participant within science" as the principles of contradiction, interaction, process, and qualitative shifts became part of the new methodologies. The reductionist and unidirectional model of knowledge production was eventually abandoned as methodologically ineffective in the facilitation of stable and geographically even rural development. Forty years later hunger and social inequality remain pressing concerns of the Indian countryside. Household deficits have also increased over these years to the point where a rural debt crisis has been pointed to as a leading cause of the unparalleled rates of Indian farmer suicides.[480] The historical continuity between such grim facts and the top-down promotion of capital intensive input packages coupled with massive rural credit programs during the GR must not be overlooked.

The Rockefeller Foundation, which was one of the most ardent supporters of the nomothetic unidirectionalism guiding initial GR technology transfer, also proved to be one of the first to pioneer a new paradigm of agricultural research. While international capitalist class priorities remain inseparable from the initiative, the Foundation was among the first to champion the inclusion of social science data in the biological science oriented research centers, signalling an end to the divorce between the social and natural sciences in the realm of agricultural development. The further extension of nomothethic practices in the realm of RF social science demonstrated that IK diffusion would remain burdened with contradictions. However, as the Indian state took steps to curb rural tension it helped create a space for more inclusive development strategies to materialize. Institutions which emerged in response to uneven development such as the SFDA and ICRISAT and the proliferation of non-governmental interventions like those of Anil Gupta, serve to demonstrate the relation between the diffusion of IK and strategies intended to mediate this rural class tension. The documents presented here demonstrate that the methodologies which facilitated these strategies

[480] B. B Mohanty. & Shroff Sangeeta."Farmers' Suicides in Maharashtra". *Economic and Political Weekly*, Vol. 39, No. 52 (Dec. 25-31, 2004), p. 5599.

became increasingly self-reflective, as well as responsive to the material and social conditions of the peasantry over time.

The initial germplasm collection questionnaires of the RF were some of the first formal scientific endeavours to incorporate Indian IK into formal research networks. The next significant moment of diffusion was revealed in the social science reports orchestrated by Chadbourne Gilpatric. These demonstrate the desire to understand the shortcomings of certain assumptions guiding natural scientific research by recognizing the value of knowledge pertaining to peasants, but fell short of adequately appreciating the knowledge produced *by* peasants. This initial interaction took place on largely unequal terms and was limited by the positivistic emphasis on "objective" criteria such as "viability", and quantifiable data which reduced the complex problems of rural inhabitants to mere statistics. The more nuanced and prolonged approaches used by the ICRISAT embraced elements of this same reductionism, but also departed in significant ways with the advent of farm systems research theory. The institutionalization of this methodology marked a shift in agricultural development which embraced the interpenetrating complexity of diverse farm systems, the limitations of natural science in articulating this complexity, and the need for enhanced social science work to incorporate farmer knowledge. The incorporation of "rapport" in the manuals for their village level studies further indicates a beginning to the end of academic chauvinism towards informal knowledge holders. It is also indicative of the dialectical nature of the new methodologies insofar as it encouraged a view of technology transfer as a dynamic social process which could be significantly aided by reciprocal and participatory approaches to the diffusion of indigenous knowledge. The case study provided by the work of Anil Gupta furthers this notion. It also offers an intimate view of the overall research process and reveals many of the more subtle, village level details influencing diffusion. Class and gender dynamics were demonstrated through his work to be critical and hitherto poorly addressed influences. Furthermore, Gupta demonstrated the value of pursuing research which not only documented the household budget and decision making process of farmers, but also valued the individual innovations they continued to produce. With this recognition he was able to espouse a novel methodology which set the precedent of demanding the equalization

of power dynamics which had hitherto hindered reciprocal knowledge diffusion between formal and informal science. The sustained interaction between these two approaches to knowledge brought their respective contradictions to light. The dialectical process which influenced the resolution of these contradictions ensured that they would recursively guide each other's development resulting in the synthesis of a new approach to agricultural science. Each moment of methodological transition along the way was marked by qualitative changes in both the collection and content of the data pertaining to IK. Gupta's socio-ecological paradigm moved diffusion closer to a synergistic level and while the application of this methodology on a large scale is beyond the scope of this thesis to determine, the establishment of the Honey Bee Network is evidence that this methodological contribution did not rot on the vine.

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Interviews:

Interview with Anil Gupta, March 12, 2011.

Interview with Vandana Shiva, March 23, 2011.

Appendix 1 – Initial Germplasm Data Sheet: "Data Sheet, ICAR Millet-Maize Collection Scheme, Pusa Institute-Botany Division, Delhi." New Delhi Field Office, Box 74, Folder 485.

DATA SHEET
ICAR MILLET-MAIZE COLLECTION SCHEME
PUSA INSTITUTE-BOTANY DIVISION
DELHI

1. Collection Number _____ Date collected _____

2. CROP _____

   Local Name _____

   Purpose grown _____

   Characteristics of this variety eg. High yield, resistant to insect, good grain quality, etc. Specify and elaborate

   _____

   _____

   _____

3. LOCATION:

   State _____

   District _____

   Village _____

   Name of cultivator _____

4. CLIMATE OF AREA;

   Elevation _____

   Rainfall _____ Inches. Starts _____ Ends _____

   Temperature during growing season _____

5. SOIL TYPE _____

6. CULTIVATION METHODS:

   Irrigation or Dryland? _____

   Manure or green manure used ? _____

   Land Preparation? _____

   Time of Planting ? _____ Harvest ? _____

   Cultivations or weedings ? _____

   Other practices? _____

7. AVERAGE YIELDS OBTAINED: Grain _____ Stover _____

Appendix 2 - Gilpatric Credit Attitudes Questionnaire: "Attitudes Questionnaire" New Delhi Field Office, Box 149, Folder 1087.

ATTITUDES

1. Do you have sufficient funds for farming and family lvining ? Yes _____ No. _____

2. If you could obtain additional money, how would you use it ?
(List in order of priority)
(Include both items for farm and home)

1. _____
2. _____
3. _____
4. _____
5. _____

3. Do you agree or disagree with the following statements ?
(A - agree)
(D - disagree)

(a) To be in debt is bad _____
(b) It brings down social prestige _____
(c) Borrowing discourages the habit of thrift. _____
(d) Borrowing often becomes a habit _____
(e) Borrower becomes _____
(f) Borrowing induces indiscrimnate and lavish spending. _____
(g) I find the procedure of borrowing too complicated. _____
(h) I feel that the interest rate is too high _____
(i) Borrowing involves b the people disbursing loans. _____
(j) Other family members don't like for me to borrow money. _____

4. (a) If you need a loan and had free choice to approach the following agencies, what would be your First, Second, Third and Fourth preference ?

Cooperative Credit Society _____
Land Development Bank _____
Commercial Bank _____
Trader or Dealer _____
Money Lender _____
Relative or friend _____
Sugarcane societies _____

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	No. of source	Amount	For how long
Formal debts			
Informal			

Have you ever had to consume the grains preserved as seed due to drought effects

Any other problem which should attract urgent attention of agricultural scientists

Specific Farm operations by women:

Operations	Suggestion for improvement
Pre-Harvest	
Preparatory village	
Sowing	
Interculture Weeding	
Application of Fertilizer	
Irrigation	
Post-Harvest	
Threshing	
Seed Preservation	
Grading	