

**Revised draft:**

## **Portfolio theory of technological change: Reconceptualising Farming Systems Research<sup>1</sup>**

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Context:

Sustainability of Farming Systems can be achieved only through Sustainable Institutions. K M Munshi, former cabinet minister for food and agriculture, realized this issue well. He exhorted the Indian scientists in a special general meeting of the Indian Council of Agricultural Research (November 1, 1950, New Delhi) to take a comprehensive view of the interrelationships between land, water and livestock resources. The ultimate objective he felt was the land transformation. He recognized the need to draw upon not only the agricultural science but also "the newer" sciences of anthropology, sociology and psychology. He organized Vana Mahotsava that is a forest festival as a national event so that every year on this occasion people would plant trees. He launched the concept of Bhoomisena (Land Army) in 1951 with the objective of 'Land Transformation' i.e. to secure the utilization of land on a rational basis so that the available resources of land, water and livestock are developed to the maximum extent. Taking a philosophical outlook in a seminar on extension at IARI (September 27, 1951) he observed:

At the Ministry of Agriculture I found many isolated and unrelated and, therefore, insufficient activities. I wanted a comprehensive outlook, a philosophy, an urge, a faith. The conception that we must replant our philosophy of life in the soil came to me again and again. How can this be done?

The first thing I realized was the intimate relationship of man, his well-being and progress with the soil, sunshine, river system, forests and the natural surroundings of his native land. They are one whole; their richness and strength are one. If this equilibrium is disturbed, man dies.

The Carthaginians, the Egyptians and the Babylonians of the ancient world were civilized in their time. But they favoured man at the cost of nature with the result that their lands, through over-exploitation, turned into deserts. Their empires disappeared; they were effaced from the earth.

On the other hand, many early races of men disappeared: the Nagas, Gonds and Todas, the Mayas and Red Indians remained under-developed and were driven into precarious existence in forests and mountains. They found nature too powerful for them to be exploited; forests and swamps were too powerful for them.

Man and his environment must act and react on each other perpetually to escape the fate of races that lived in conditions in which equilibrium had been disturbed and they knew not how to restore it. Land Transformation is, therefore, the art of maintaining the equilibrium between man and his environment". (1951 : 119, emphasis mine)

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1. Revised version of an earlier paper entitled 'Portfolio Approach to FSR and Extension: Theoretical Departure' presented at International FSR symposium at Michigan, Oct 1990
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Can a better definition of the goal and philosophy of farming system research is available. Is it possible to dispute the logic of hydrological cycle and the nutrition cycle that he spelt out to visualize linkages between crop, live-stock, tree etc. In 1952, while speaking about **The Gospel of Dirty Hand** he said,

For the soil, hand of the worker on the land is the magic touch which starts the unbroken change of action and reaction from the soil to the spirit, transforming the organism of life.... Informative publicity has no power to move the collective mind to action. Such power comes from an idea tabloided in an expressive and significant phrase which moves men to action. We know the power in the word Sathyagraha and 'Quit India' wielded in our recent history; they opened the flood gates of the mass response....I coined the phrase land transformation - Bhu Parivarthan or Bhoomi Parivarthan - just to emphasize the anchorage of our movement in the soil. By using the word 'Extension', you are shutting the door of mass consciousness to the work before you. **The** word 'Extension' has no appeal to our sub conscious mind. It is an American word, the full significance of which is known obscurely only to a few; even 'extension' in education is familiar only to our academic world. It has no meaning for the vast number of our educated man; to them 'Extension is just Enlargement'. To the farmer it is strange and unfamiliar, a new-fangled, incomprehensible idea. And it is likely to encourage our middle class workers and officials to by-pass the unwelcomed gospel of the dirty hand. Let us use words which evoke a response in our sub-conscious minds (1952; 183, emphasis mine ).

This is precisely the point which has been missed by most researchers involved in the game of Institution building. Be it RRA or FPR or FSR, our inability to root the concepts in the cultural and philosophical bedrock of a society prevents us from grafting or budding an idea in an already growing tree of knowledge. Transplantation of an alien knowledge tree in the post modernist society appears queer to put it mildly and shameful to put it strongly. It discounts the respect which human ingenuity deserves. It also discounts the validity of eco-ethics underlying the history of thousand of years old cultures of Andes, Africa and Asia. This is the context in which I want to discuss the process of locking into the people's knowledge system.

Dr Y P Singh ( Professor, IARI, New Delhi) started perhaps the first formal attempt to guide post graduate research on the issue of indigenous knowledge of pastoral communities in 1964 when he was at agricultural university, Hisar<sup>3</sup>. Dr Singh realized the hard way that he could not challenge the orthodoxy of Extension Science establishment when he found that the examiner of the post graduate thesis would not pass his students. His objection was that the discipline of extension dealt with the process of extending knowledge from the lab to land. These studies attempted to do the opposite, with lots of arguments and discussion the theses were awarded. For about fifteen years, no further research was guided on the subject till another student took up thesis research on indigenous dry land technology and extension science research. Subsequently several more these were done on the same subject in south as well as north India.

I argue in the paper that in high risk environments the high degree of ecological variability makes it well nigh impossible that traditional models of extension be used. In any case there is not much to transfer. At the same time farmers have been trying to survive in these regions some how. It is true that with worsening of prospects of their survival, their household portfolios have been shifted towards some of the environment degrading resource mix. Survival in the short term takes precedence over the long term sustainability of resources. It is for this reason I have argued that portfolio approach is necessary for developing a viable approach to fsr and extension in high risk regions.

Despite these struggles, people have not stopped being inventive. As a part of a recent survey done in Gujrat we found that lot of innovative practices are being used by the people in some of the most inhospitable dry regions ( see accompanying newsletter, Honey Bee **Vol.2.1**, 1991).

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3.Earlier, Majumdar had written in Calcutta a tract called as "Vaaaspati" on the Indian concepts of Botany. There are several other studies on indigenous knowledge which will be reviewed in the paper.

Several implications for reconceptualising extension science follow: (a) need exists for recognizing that knowledge systems are culture bound and involve nested meanings, (b) the science of innovative practices has to be drawn first and fed back to the people to reinforce their experimental ethic. Only after this has been done farmers need be told about the irrationality underlying their other practices, (c) value should be added to what people know rather than only highlighting what they do not. It is important because the moral restraint for sustainable resource use is supplied often by some of traditional cultural values rather than by the modern technological consciousness, (e) the relationship between communication and power must be appreciated so that the dominance by the so called 'opinion leaders or progressive farmers' is replaced by the 'knowledge rich but material resource poor' farmers, (f) strategy for low risk regions should be differentiated from the strategy for the high risk ones. The eco-specific organizational designs should be developed, and (f) culturally rooted metaphors should be used for strengthening the experimental ethic of the farmers.

#### Traditions of Farming Systems Research: existing gaps and need for portfolio approach

There has been a long tradition of farming system research studies in the developing countries where much of the rural survival systems are characterized by interlinkages between crop, livestock, tree crafts etc. The policy emphasis on culture specific development in the earlier years of independence in India signified this approach (Munshi 1959). It is not surprising that some of the early varieties of wheat, paddy millets, pulses and oilseed developed in India in pre and post independent India continued to be not only popular in many high risk environments but also provided for source of genes characters like adaptability, straw quality, taste etc. However, with the advent of input intensive technologies in the era of green revolution the emphasis became much more sectoral and also segmented. The terms sectoral and segmented imply emphasis on only a few parameters such as grain yield and quality rather than on grain and straw quality or lower harvest index or selection for plant types suitable for mixed cropping or varieties which could perform optimally with low supply of external inputs. The revival of interest in farming systems approach in a way is an attempt to correct this distortion.

This is not to be little the developments during green revolution which have indeed widened *the* human choices . After all there is no free lunch . If we wanted high yields without supplementing all the soil nutrients , it was inevitable that we should mine the native fertility of soil. Whether we should have ignored the science underlying this mining known to the scientists ail that while is a valid question and discussed elsewhere (Gupta, 1990). The sustainability of high input oriented, soil mining, pest inviting and pampering, gene eroding technology was always suspect. But Shis issue needs separate discussion. Suffice it to say that sustainability in nature is sought through diversification. And portfolio approach takes diversification as the basic building block of survival strategies be it of a household or a firm.

The need for taking multi enterprise approach becomes much more evident in high risk environment where fluctuations in the environment require flexibility in the pattern of household resource allocation. Even though much has been written about the interlinkages between various enterprises in which households have been engaged in, a consistent theoretical framework has been missing in most of the studies. The methods have dominated the meanings which can be derived only in a given theoretical context.

Second major gap has been lack of correspondence between micro and macro level perspectives. The national and regional policies have been often taken as exogenous variables without identifying the processes through which households respond to this policies in addition to the technological and ecological dimensions. The third gap is about the role of ecological variables in definition of technological parameters of household choices. Excessive emphasis on attitudinal and sociological dimensions in regions where the contribution of ecological variables may be dominant may stem from inadequate conceptual framework. Sometimes this error may happen because of methodological limitations also.

The fourth gap though less evident than the first three relates to institutional dimensions. The linkage of farming system research with the institutional structures and systems has been only weakly pursued. The literature

from organizational theory stream has often not been drawn upon adequately and in the process the supply side dynamics has often been underplayed. The fifth gap relates to the ethical and value dimensions. The choices of managers, field workers and administrators in research and support system such as banks, input agencies, government departments etc. are substantively influenced by the value positions and ethical dispositions. In the same manner, the values of the farmers and farm workers are no less important. The role of historical traditions, culture, religion and social institutions in shaping these values and in turn influencing the household technological choices has not been adequately incorporated into the theory of farming system research. The sixth gap pertains to the interdisciplinary nature of the studies. The insights from economic theory be relating to public goods, common property resources, club goods, structural/dialectical framework; finance and account theory, business policy and other streams of management sciences have not been assimilated. The seventh gap is in establishing linkages between the on-farm research with the on-station research, post graduate education, basic science research, financial management systems in the research organization and the indigenous knowledge of the peasants, men and women.

All these gaps become far more serious when one notes the tendency in the literature to ignore the references from the third world particularly the ones which may not be in English language. Excessive emphasis on labeling and terminological adventurism has distracted attention from substantive issues to the peripheral ones. Tracing history of FSR only from seventies and thus ignoring decades of work in various countries is another limitation of the current research particularly in the west. To illustrate the terminological mis adventures a good example would be the term "resource poor farmers". It is pity that it has been lapped up by the professionals in developed as well as developing countries without proper scrutiny of the underlying meaning. For instance the knowledge richness of the farmers, pastoralists and workers is masked under this definition. Implicitly knowledge is either not considered as a resource or people are not considered rich in even this resource. Either way the terra is inappropriate. The more appropriate phrase may be disadvantaged households which highlights the fact that some other people may have the advantages in so far as social or material resources are concerned.

In this paper I present a multi level approach to study the household, enterprise mix or portfolio choices to identify frameworks in which specific studies can be made. I am conscious of the fact that much more work will need to be done before a general theory of household portfolios can be developed. However, at the same time, I realize that in the absence of such an attempt the studies will remain partial and also delinked from institutional, historical and socio ecological context. In a separate paper I have argued that a programme of research which depends heavily on international donor support is unlikely to be embedded in the respective cultural and organizational setting of different developing countries. Further, lack of attention to these linkages among different economic enterprises within developed countries has not received adequate attention. The result is that two different sets of values seem to be propounded for reaching the same goal in developed and less developed contexts.

In the first part of the paper I discuss the analytical framework at macro, meso, and micro level. I describe first the logic of household portfolios and how these are influenced by individual and collective beliefs. I conclude this discussion by looking at the portfolios as performance. I discuss next the 4-S model interlinking space, season, sector and social stratification. I then pursue the linkages between access to the resources particularly the ecological ones but also, the market ones, assurances about future returns and others behaviour vis-a-vis ones' own, abilities or skills and attitudes on one hand with ecological resources, institutions, technology and culture on the other. I then elaborate the eco-sociological framework in which the relationship among the household portfolios, risk perception and response to modify the portfolios, overtime and space is discussed.

In part two I discuss the ways of operationalizing this theoretical framework.

In part three I present the areas for future research.

## Parti

### Multilevel Multi-institutional approach to Evolution and adaptation of the household portfolios

#### a) Portfolio as performance:

« Whenever I have to plan my investments I look at various choices in context of my own family needs, unforeseen circumstances, our cultural preferences for consumption and maintaining a particular lifestyle and our sensitivity to our obligations to others be it our relatives, friends, neighbors or colleagues. Thus while I make most choices on the basis of economic evaluation I do not make all choices on economic criteria alone. Certain investments are made to remain in good books of those whom I value or adore. Certain investments are made just for fun or satisfying my **own** or my family's aesthetic or cultural needs. Certain investments are guided by our lifecycle perspective and our own age and demographic stage. In some decisions I consult a financial expert, in others I take advice of spouse, children or parents and in still others I just gamble. Sometimes out of curiosity, sometimes just because that has been the way I have been doing it. Many choices are made by my wife even without consulting me and I accept that as a fairly comfortable division of responsibility.

The mix may be of long term versus short term, easily liquid versus less easily liquid, status linked versus status indifferent, ancestral versus acquired, coupled versus uncoupled<sup>4</sup> or storable versus non storable assets. My portfolio will obviously be an outcome of the whole range of factors not all of which are economic and sometimes even rational from a narrow utilitarian perspective. I keep certain assets because I like them or because I have found them useful at sometime and have an emotional attachment. There is no reason to believe that a farmer just because of his poor and disadvantaged status loses his rights to nurture emotions or do things which may appear irrational from a narrow economic utilitarian perspective. I also shift my portfolio as I move up in the career or my family expands or my responsibilities increased or decrease. In Indian context if my sisters or daughters are to be married, my portfolio persuasions and motives in appraising my choices may be quite different from another person having same status, age, asset structure and future prospects. The farmer may keep a tree even if it obstructs sunlight for his homestead and makes the cultivation of vegetable more difficult. Because selling this tree at an appropriate stage may provide him a cumulative saving which may be very difficult to organize through saving money. Likewise I may be able to indulge in a forward trade of a tree if I find that immediate cash compulsions are very high. And at the same time buyer feels that proper returns from the tree would be available only after a few years. Buyer discounts his returns just the way seller discounts his returns and a particular outcome may be rational for both of them because they may be using same or different discount rates or may be having same or different utilities of the amount received or paid. The portfolio approach thus to our mind is a necessary dimension for analyzing farming or survival systems which may include non farming options as well. We must also recognize that several assumptions of linear programming or other such models do not hold good when we evaluate the processes through which different assets have been acquired. Likewise the rules which may guide the disposal of these assets may vary from asset to asset and not just because of the choices that household can exercise autonomously and independently.

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4. Coupling refers to such assets which are interlinked and cannot be used in isolation. For instance a cattle shed and a cattle are linked but not coupled because we can keep cattle without a cattle shed. However a bullock and a plough are coupled. We cannot use plough without bullock and bullock without plough or in some cases can or thrashing roller or weeding hoe as the case may be. Thus the decision of keeping a bullock may sometime guide acquiring another asset in the portfolio which may on its own economics be not justified. Since the decision to keep cattle is non negotiable for whatever reasons cultural or emotional, further decisions are then to be evaluated keeping the first decision as given. The price of inefficiency or sub-optimality may be paid on account of improved utility achieved from better utilization of bullock in such a case. There may be many other factors such as need for autonomy during crucial farming stages which may justify keeping bullock in the first place. Though enough work round the year may not exist for it. Such assets which are tied in use are called coupled in this paper.

I have argued elsewhere (Gupta 1984, 1985 and 1990) that a household portfolio may include assets which may be maintained through the resources drawn from other private assets, open access assets or common property resources. Various property right regimes generate externalities of different kinds on the individual household choices. These externalities may some time be class specific and sometime may be function of ecological or biological resources. The conventions and customary rights whether honored or not honored by the state may also influence the way households appraise their individual portfolios vis-a-vis their access to various resources governed by different property rights. As I will show later the access to resources, the assurances of future returns as well as about collective behaviour and abilities or skills to convert access to investments influence and/or are influenced by the attitudes shaped by the cultural traditions individual experiences and certainty and uncertainty about future outcomes.

Portfolios are assessed not merely by assuming that I am independent in my choices. If my neighbors don't like the smell of cooking meat and if I value my good relations with my neighbors I do not try to satisfy my consumption requirements by cooking meat I rather purchase cooked meat. If my neighbouring farmer irrigates its field with the result that water seeps through to my field where I want to grow rainfed chickpea or gram my choices are foreclosed by my neighbor. My field does not require too much moisture whereas her field does. If I cannot persuade my neighbor to do otherwise my portfolio gets modified by my neighbor's choices. Likewise if nobody else grows maize or hybrid millets and only I grow it, all the birds in the region pounce upon my field and increase my cost of supervision and defense. If everybody did it, defense as a common good would have reduced my private cost and changed the outcome. There could be other instances in the field of plant protection which are of even more serious nature and generate externalities which modify individual household choices. With modification in one sub-system say land related enterprise my choices in other subsystems are also influenced. I have argued that household choices particularly by the deficit budget farmers cannot be appraised in credit, product or labour markets independent of the choices or constraints in other markets. (Gupta 1981, Bharadwaj 1974).

In addition to the culture of deference for others' feelings, my individual predicaments, portfolio choices and outcomes may also be affected by my religious and institutional preferences or limits. My contention is that fanning system research while taking note of linkages between crop livestock and tree sub-systems has used a functional perspective. It may be inadequate because it misses out historical insights into the dynamics of portfolio formation and evolution.

There is a view that sometimes portfolios have to be seen as an outcome of a performance (Richards 1989, Box 1989, Gupta 1990). There is a saying in India and perhaps some other countries too that traveling together may serve a greater purpose than reaching somewhere. The performance is also a simultaneous act in which sometimes the most imperfect drama or musical concert moves the audience most whereas a perfect concert or a performance fails to move the audience. If life is a performance and portfolios are merely the acts in the long chain of performances than the perspective gets transformed. This is not to say that audience cannot participate in a performance. Or that it cannot insist on reinterpreting the roles.<sup>5</sup> But we have to recognize the role playing before we can inter-

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5. There is a story of a tribal boy Eklavya. He was a Bhil living in a forest. He was interested in learning the art of archery from a guru famous for his teaching of this skill viz: Guru Dronacharya. The Guru did not admit students from lower castes and only admitted the wards of kings or royal families. Eklavya after having been refused admission relentlessly pursued his practice of archery. He made an idol of Guru and practiced before it every day. After some time Guru with his chosen five disciples (famous Pandavas of the epic Mahabharat) was walking through the forest. A dog started disturbing their conversation. Eklavya practicing in the same forest heard the voice from a distance. He had earlier seen that his Guru was walking through the forest. He aimed his arrows just by hearing the sound and killed the dog by arrows so that it could not disturb his Guru. Dronacharya was dumbfounded. He could not believe his eyes. He had taken a vow to make Arjun the best archer in the world. He had now discovered a person who he thought was better marksman than his chosen disciple. They went out in search of the person and soon discovered Eklavya. Guru asked Eklavya about his teacher. Eklavya replied that Guru Dronacharya was himself his teacher. Guru recalled that he had not admitted this student but then saw his idol lying there. Quickly he demanded the thumb of the right hand of Eklavya as a guru dakshina (fees) for having taught him (if he

vene to change the meanings of the roles. We should also recognize that some of her roles may be performed under rationality which our scientific instruments may be unable to unravel. The students of bio dynamic agriculture are slowly recognizing that sowing according to the lunar calendar sometime provides effective ways of synchronization which may be necessary to overcome the problem of pest population build up. In case of hybrid Sorghum, scientists after several years of research realized that if only farmers could synchronize and advance the sowing slightly they could control the pest. Performing a ritual in some cases may thus be a way of achieving order in a process which otherwise may seem chaotic. Theory of Chaos teaches us that search for an order may sometime have to proceed at a different plane than the one in which a particular act has been performed or perceived. I do not deny the irrationality of many rituals. And at the same time the rationality of some others cannot be denied just by definition.

Other dimensions of performance simultaneity, coordination, deference for collective rewards, synchronization etc. The choice of technologies by the household can be understood better if we also look at portfolios as performance and then study which roles have to be modified for improving the overall impact of the performance. Emphasizing on a specific role may be justified to begin with till we learn the art of script writing or interactive performance. The outcome will be partial till we recognize the need for change in multi-role enactments.

b) Portfolio outcomes of Interactions between space, season, sector and social exchange relations:

During transition from my biological science training to social science career, I realized that social scientists had a great preference for sequentialism and sectoralism. Contribution of space or ecological variables organized over space through niches was often unrecognized in the sectoral equilibrium oriented analysis of demand and supply constraints. (Mabugunje, 1979, Gupta, 1981, 1984; Biswas and Biswas, 1979; Richard, 1985) I also realized much later that ancient conceptualization of agriculture and its relation with nature had always emphasized linking space, season, sector and social systems. Therefore while I may take credit for the sharpness of this relationship I must acknowledge that the relationship was always recognised in the most ancient Indian and Chinese texts. It may have been there in other traditions to though I am ignorant about them. The tortuous route I took is an indication of my own inability as well as the bias in our curriculum towards western models and utter neglect of traditional concepts and theories no matter how valid.

#### 4-S Model:

Several studies on farmers adjustment to risk have shown a multi market, multi-enterprise and multi-institutional approach to survival (Jodha, 1975, 1979, Jodha and Mascarenhas, 1983, Gupta, 1981, 1984, 1988, 1990, Ostrom, Picht and Feeny, 1989). The multi market approach refers to the farmers' attempt to adjust to risks through simultaneous operations in different factor and product markets. The factor markets include land, labour, capital and perhaps even information. The product market include crop, livestock, trees etc. including various technologies of land and water use. The higher the risk in environment, the greater the dependence between the decisions made in one resource market and those made in others. These links are important in well developed regions also but in these regions, many imperfections in respective markets often can be offset through market

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indeed was Ekiavya's guru). Eklavya readily sacrificed the thumb.

This story is taught to almost everyone in India as an example to foster obedience and perseverance. I have asked my students to interpret the dilemma in the mind of Dronacharya and Eklavya before the sacrifice was enacted. They almost always failed to imagine any dilemma in the mind of Eklavya. People have tried to reinterpret this myth so that traditional enculturation of compliant behaviour and respect for a teacher even if he was behaving in an un-ethical manner did not continue. Two lessons follow from this instance. One farmers may be doing things which may have been valid in a particular cultural context. Second in the light of social democratic feelings and liberal attitudes towards human freedom and choice certain values may be considered retrograde by the society. In such a context, reinterpretation of traditional myths might be necessary. But one can try to reinterpret only when one recognizes the role played by social and individual performance. And in that the role played by myths and other aspects.

mechanisms themselves overtime and space. In high risk environments the cost at which these errors may be repaired may be far higher and thus greater dependence on inter-market adjustments.

The multi enterprise approach implies that farmers' adjustments to risks or evolution of portfolios cannot be understood by concentrating on any one enterprise such as crops, livestock, labour or trees etc. The 4-S model helps understand these linkages at the macro level.

The multi institutional perspective is helpful because various resources or enterprises, as mentioned earlier may be governed by various kinds of property right regimes in combination or separately. Livestock for instance may be managed by some households through biomass derived from only private land. In other cases it may be derived from private as well as common and or open access lands. Thus various institutional arrangements whether or not regulated by the state, market or both further influence the choices at micro level. Any framework which ignores multi market, multi enterprise and multi institutional dimensions of household portfolios may generate only partial understanding of the survival logic of the people. The innovative technologies or institutional arrangements are a part of dealing with these complexities. Innovations of survival sometime may follow rules that are different from innovations for accumulation.

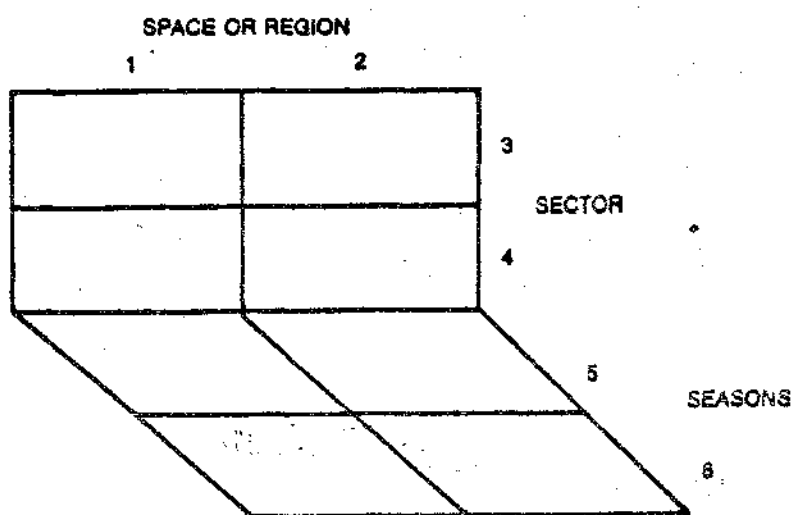


Figure 1

Each dimension can be dichotomized for the purposes of creating ideal types. The basic principle of logic that we use here is 'compare and contrast'. If we want to understand a phenomena it may be useful to begin with comparing and contrasting the extreme values of its distribution.

For instance, 'space can be dichotomized in terms of high or low population density. It could also be contrasted in terms of high land or low land, undulated and plain topography higher slope or lower slope in the mountain regions etc. Likewise 'sector' can be dichotomized as agriculture or industry public or private, specialized or diversified, single crop or diversified crop combinations; cash crop or food crop dominated assert portfolio. 'Season' can also be contrasted into uni or bi modal rain fall regimes, arid or humid, low or high rainfall, tow or high diurnal temperature variations or low or high seasonal fluctuations. {This is essentially the dimension of time with which is associated the uncertainty).

Given any two parameters we can speculate about the third. For instance, in a region with low population density and high seasonality (low rainfall and high diurnal temperature variations in the arid plains and low diurnal temperature variations at the high altitudes) the sectoral characteristics may be highly diversified. Instead of a



single crop farmers may prefer mixed or intercropping in several plots if not all. Households may simultaneously pursue many activities such as crop, craft, livestock etc., at the same time rather than being dependent on anyone of these. The social exchange relations in such regions will be quite different compared to the regions with high population density, low seasonally and specialised sectoral activities or diversification for accumulation rather than survival.

Some of the characteristic ways of social exchange relations may include the following : (a) the predominance of kinship and external family networks over the nuclear family systems to hedge risks (b) preponderance of non monetary exchanges and the informal mechanisms of pooling<sup>6</sup> of bullocks, implements inputs etc., (c) dominance of generalized reciprocities over the specific ones<sup>7</sup> and (d) choice of a much longer time frame to settle book of accounts compare to shorter time frame.<sup>8</sup>

The communication system in these regions are far more metaphorical or analogical rather than digital. The strategies of technology transfer in on farm research and extension systems would obviously have to be tailored to the typologies which can emanate from the simple matrix given above. One can make it more complex and generate richer insights but parsimony has always price. I must acknowledge that nature of institutions and market interventions can modify the initial conditions that may be predicted by the configuration of spatial, seasonal, sectoral and social variables. It might appear that some of the social relations are defined by the ecological variables in a deterministic manner. We have seen that relationship between pastoral and cultivating communities in Swiss Alpines on mountains (Netting 1972), northern Pakistan (Buzdar, 1988), Bhutan and some other Himalayan mountain regions (Gupta and Ura 1990) have striking similarities though specific parameters may vary due to cultural and religious differences. Over time however, formal institutional inroads and market developments do modify these strategies. Availability of a walkie talkie to a Swiss pastoralist does not require development of or retention of specific whistling styles as observed in Andean mountains or in Himalayan Mountain regions. However, the need for surviving collectively is felt in almost all such socio ecological conditions.

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6. Anthropologists have provided rich insights about the pooling mechanisms in various societies living in hill areas, and regions or forests. Pooling of bullocks in Maharashtra for instance, is called *irjik*. As many as 10 to 12 pairs of bullocks can be seen ploughing the land in a particular catchment area across the fields at a specific gradient. Since the moisture could recede faster near the ridge line the plots along the contour towards the ridge have to be ploughed first. It is possible that some people may contribute one bullock pair though they may have only 1/2 an acre or even so land in that niche. While others may have much larger tract of land in this niche and yet contribute the same pair of bullocks. The obligations for feeding the cattle and the ploughman are also worked out in many diverse ways. What is important to understand is that uncertainties over time and space may generate reciprocities which may be settled over a longer period of time and thus generating rationality of choice in the short term.

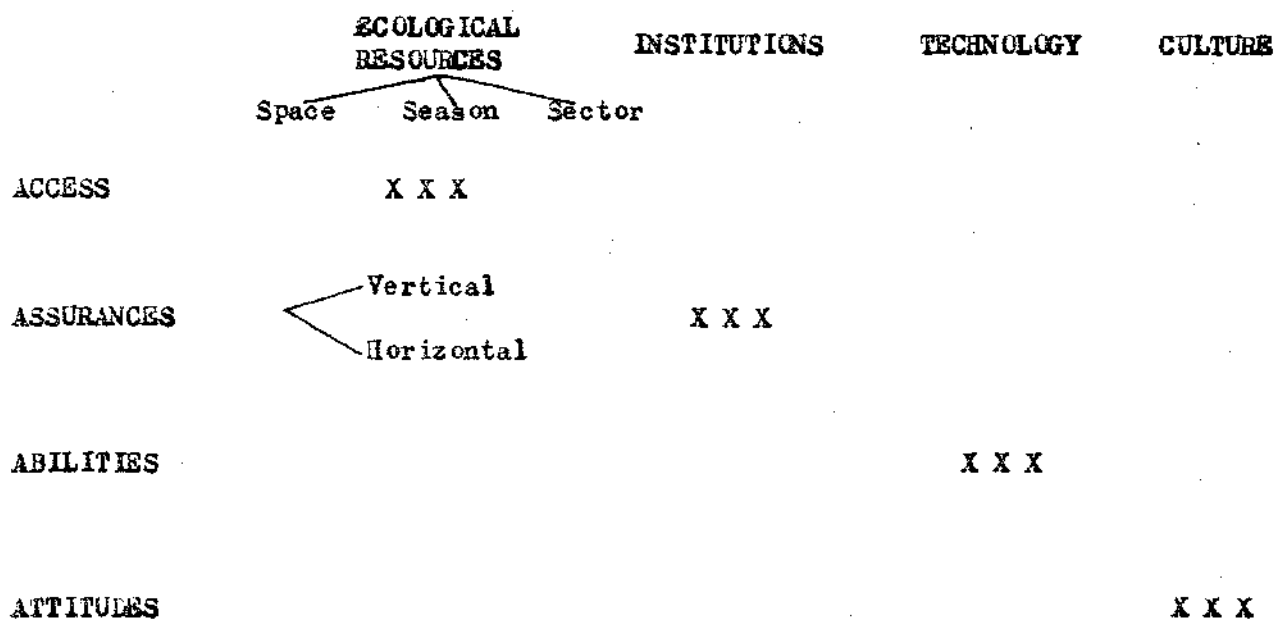
7. The generalized reciprocities refer to exchange of labour for thatching the hut with labour for ploughing the land. It is very difficult to work out the equivalence between such unrelated activities. How critical thatching is before she rains only a poor family living in such hut can realize. Likewise the criticality of draft power in receding moisture conditions in Silt soil regions can be understood by someone who may miss the entire season in the event of failure of sowing the crop in right time. The traditional economic theory can be of limited help because equivalence is not just the value of labour as assessed in the market place. Some times a help provided in such a context may generate I.O.U which may be redeemed much later. The specific reciprocities on the other hand refer to exchange of same goods or services. I have paid for your tea today you should pay for me tomorrow. Or I have given you five kilograms of wheat seeds and you return the same amount of the same crop later. The commercialized societies often would have dominance of specific reciprocities. Decision making with constrained resources cannot be analyzed without looking at these reciprocities.

8. Simiks have shown that I.O.U. are settled in the regions described here in far longer time periods extending to sometimes several generations. A good or a bad turn may invoke a return gesture not necessarily same day or in same month or even a year. Even the nature of factional leadership remains divided at village level for longer period than at the state of national level where loyalties can shift quickly without generating problems of legitimacy or social acceptance.

c) **Eco Institutional Framework:**

Human choices in a given eco sociological configuration are circumscribed by the historical evolution of institutional structures. The Institutions provide a framework of rules, sanctions and meanings which are commonly understood by group of people within a boundary. In a way Institutional behaviors rely more and more on internal commands rather than external demands. However, a combination of both moral and material sanctions provides legitimacy to an institution. In the present context we are drawing upon another feature of institutions which in the context of farming system research is extremely vital. That is the assurance provided by the institutions - formal and informal to individuals and groups about various uncertainties faced over time and space. We deal with mainly two types of assurances - horizontal and vertical. The former includes the assurances that provide guarantee about others' behaviour vis-a-vis one's own. Thus if I sowed my crop early will others also sow likewise. Or if I did not graze my animals on a common land will others also cooperate? The vertical assurances refer to the future returns from present investments. If I plant trees on the common or private land will I be allowed to harvest it. Or if I apply organic fertilizer to a particular plot of land taken on lease will I be allowed to get it next year also (in view of the slower release of nutrients from the organic fertilizer).

The assurances by themselves however are not sufficient. If I have assurances of better prices or better returns or collective behaviour but I do not have access to the given resource or I do not have the skill or ability to convert a resource into investment or both, then assurances are of little use.



**Fig: 2**

The assurances help in generating a cooperative behaviour when we deal with common properties (Sen 1974, Rang, 1984, Gupta, 1985). In case of private resources assurances may stimulate demand for better access or technical skills or both. Likewise if we have an institution in which people have access to resources and also have assurances but do not have the skills or abilities, the investments would not follow.

All the three vectors of choice that is access, assurances and the abilities must be synchronized to generate appropriate attitudes for change or maintenance of a resource use systems. Thus within a specific spatial, sectoral and seasonal configuration portfolios may vary within a given range because of changes in access assurance and abilities.

As we note in the figure 2, the access to natural resources, assurances from the institutions, ability in terms of technology and attitudes in terms of culture collectively influence the household portfolios. This framework also helps in designing interventions. Thus if we want to introduce technologies which pre suppose existence of certain skills, access modes or institutional structure but some or all of these vectors are missing we should not fault the people for not utilizing the given opportunity. It may be useful, therefore, to recognize that this framework can be used as a tool or as a filter to assess available information and generate further choices. If we know the given complexity in the available system of access and the abilities of the people we should be able to anticipate what type of assurances would generate or respond to the given attitudes. Attitudes here are both outcome of historical experiences and are also inputs into the future choices. The culture, I must add, does get modified over a period of time.

The same framework can be used to analyse the supply side that is the response of the scientists to various types of problems or social situations. For instance if scientists do not have (a) assurance of peer approval (collective choice or horizontal assurances) or (b) career rewards (vertical assurances) but have (c) access to the facilities for on farm research and also have (d) the skills for performing experiments, we should not be surprised if they develop attitudes which are conservative or non enterprising. In the same manner changes in different parameters may help us in identifying the corresponding changes required in other parameters.

The conceptual discussion on on-farm research has often ignored the supply side (for exception, see Collinson, 1987 or ISNAR's OFCOR studies) or considered it totally and inherently unresponsive to the farmer's needs (Chambers 1984). I strongly critique the attempts to suggest that technology should be generated only in response to the articulated needs of the farmers. As I will show in the articulation - response model given below, which needs are felt and which not in fact depends upon many times the way supply side has responded to the previously felt needs. Further science and technology may provide alternatives which a user may not have even imagined and thus not demanded. Under what conditions would scientists apply what type of alternatives may of course depend upon the inter relationship between their access, assurances and abilities and the cultural attitudes. The assurances and attitudes may also influence the accountability that scientists had towards the farmers of various classes. The portfolios of the households and portfolio of opportunities of the scientists are influenced by the rules of the game

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9. I have argued that institutionalisation of farming system research cannot take place no matter how many millions of dollars are pumped in by the donor agencies unless it links up with the overall research management system. Thus if the on station research experiments are not started, modified or stopped on account of the feedback from the on farm research there is no reason to expect that on farm research would respond to farmers problems in any specific sense. The assurances from the colleagues about utilizing the feedback is an important detriment of the generation of the feedback itself. The on-farm research in such cases will remain as adaptive trial programme.

Another aspect of the horizontal assurances relates to accountability. I have argued that horizontal accountability between farmers and the scientists cannot exist in the absence of vertical accountability between seniors and the juniors. (Gupta, 1984 1987). I have also argued that unless the vertical lengths are loosened the horizontal links cannot be forged or tightened (Gupta 1983, Mathur and Gupta 1984). It is unfortunate that ISNAR'S studies on on-farm client oriented research could not assimilate these suggestions in their framework and thus failed to generate corresponding guidelines based on empirical data.

in respective cultures.<sup>10</sup>

**d) Articulation-Response model:**

In this model I present a relationship between the needs - both felt and unfelt - and the response of the supply side in this case the institutions.

Which needs are felt and which not may be a function of historical experience, 'learned-helplessness', expectation of supply and sensitivity to the environment. Every time a new opportunity emerges, or a new populist policy is announced the receiver or consumer of the information may try to stake his or her claim for the relevant good or service. Once the needs have been felt they have to be articulated. There are several channels through which these needs can be articulated as given in annexure 1. Once articulation has taken place it must be aggregated so as to generate pressure on the supply side. An isolated articulation is less likely to make supply side responsive than an aggregated articulation. An articulated need has to be registered with the relevant institutions so as to become a demand. After registration the institution has to respond favourably or unfavourably. A favourable response may encourage a household to feel the need for articulation of the same need more often, and different needs, which were not felt so far, sometimes.

The portfolio of the households and the scientists thus gets modified by the institutional choices available in the given Articulation-Response framework. Social movements and farmer's agitations do bring about quantum shifts in the capacity as well as willingness of the supply side to respond to various demands of the farmers. At the same time we have to recognize a historical reality that farmer's agitations are seldom noticed around the problems of cultivating millets, pulses, oilseeds etc., and tending small ruminants. It is the cash crop which often becomes the rallying point for agitations in the high growth regions. The implication is that the scientific responsibility for responding to unfelt and unarticulated needs of the disadvantaged farmers in high risk regions is all the more high because consumers are quite unorganised.

Within a given eco-sociological and institutional context the articulation of needs modifies the portfolio evolution. Above elements can be interlinked in a dynamic Eco-Sociological framework.

**e) Eco-sociological Paradigm:**

I make two assumptions: (1) Ecological conditions define the range of economic choices that can be sustained in given region; (2) The scale at which different enterprises are selected however, is a function of the access to factor and product markets, kinship networks, public, private and common institutions, historical resource reserves etc. Instead of calling it socio- ecological as I did it so far, I call it now eco-sociological because of the dominance of the ecological dimensions of the socio-economic processes.

Earlier it was assumed that in any given ecological niche only certain economic enterprises were feasible at the given level of technological and institutional infrastructure. However, I modify this condition to suggest that ecological endowments of proximal environment where a social community is located need not be the major determinant of portfolio. The distant environment where the community has customary or traditional rights

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10. For instance, many western scholars would like to argue for participation of farmers in the design of technologies in the third world but would not argue in the same manner for the involvement of disadvantaged farmers and farm workers in developed countries. For certain exceptions see the studies by L Busch (1984) and Kloppenburg (1987). They have described the case of mechanical harvesting of tomato in California, as well as synthesis of substitutes of vanilla and sugar through biotechnologies, implications exist for farm workers of California and cultivators of Latin America and some other sugarcane growing countries respectively. The problem of accountability also arises when (western writings often ignore the conditions to work in the developing countries particularly when the work may require acknowledgement to conceptual contributions. Absence of such an assurance may snap communication between the socially concerned scientist in the west and the east just as it may snap the communication between the third world scientists and the third world farmers. The problem of not acknowledging farmers contribution by the third world scholars is as serious as the earlier problem about some of the western scientists. I must add that there are exceptions, and quite notable ones, to each of the statement made here.

## ARTICULATION - RESPONSE MODEL

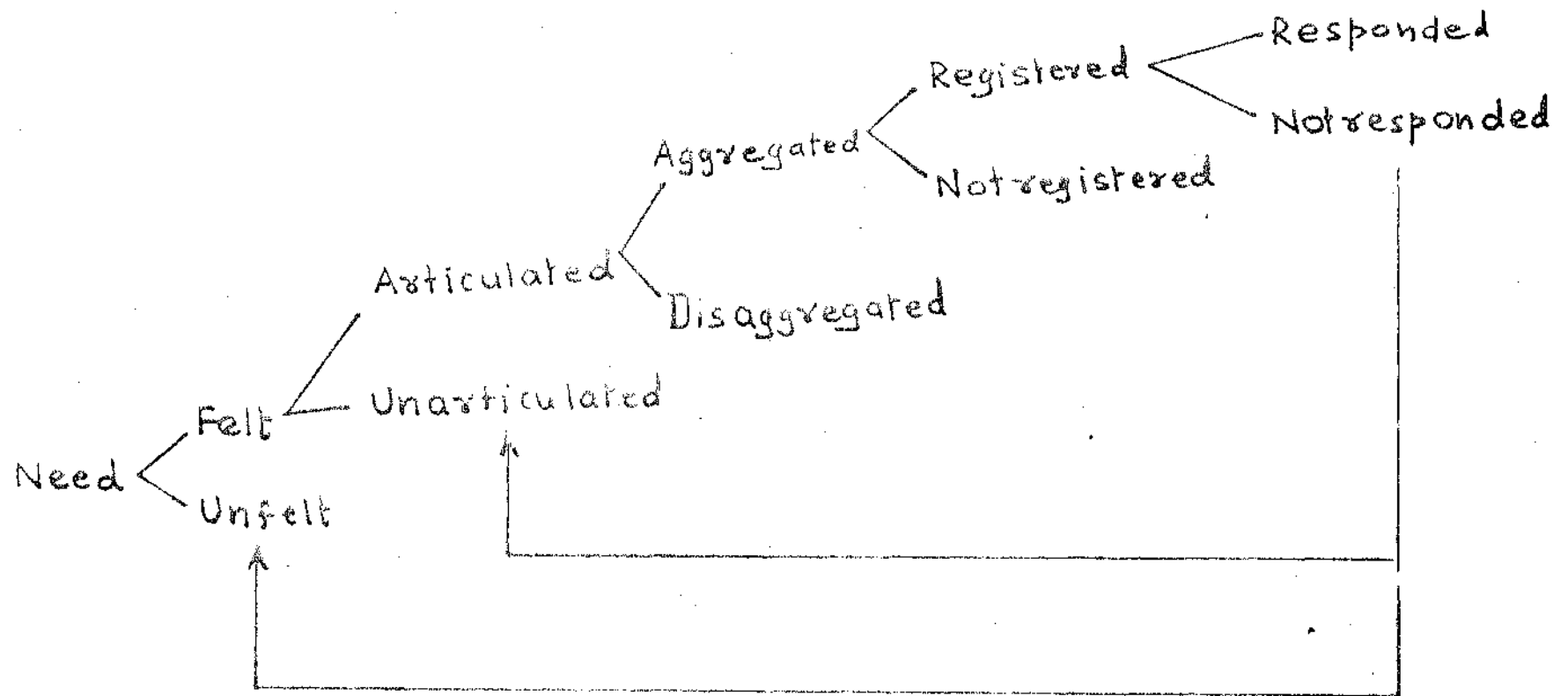
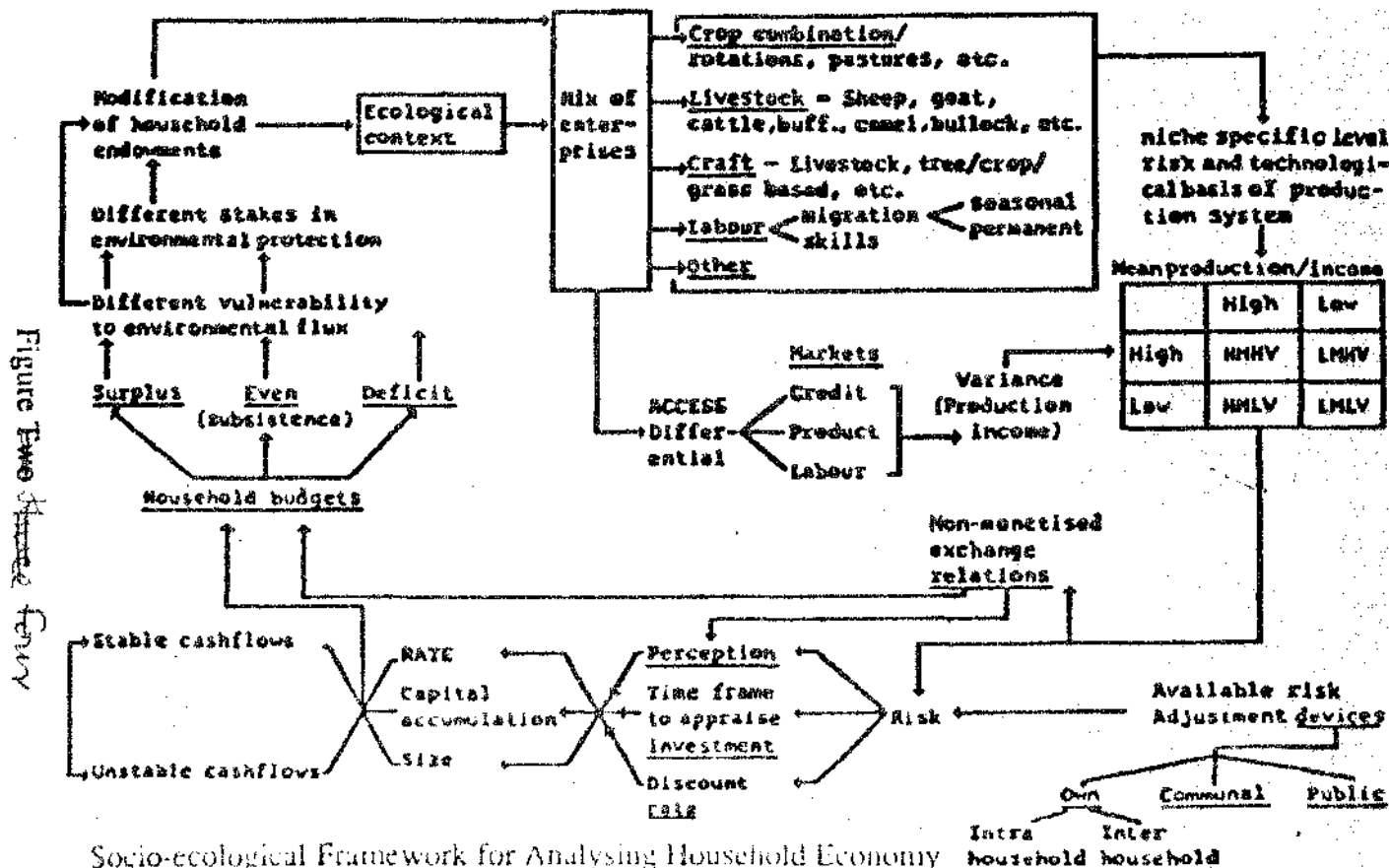


Fig. 3



**through migration or any other such means have also to be taken into account**

(Insert figure 3 here)

Thus once a mix of enterprise or a portfolio is selected drawing upon resources from private, public and common properties, the nature of risk inherent in these portfolios can be analyzed through a matrix of mean or average return and variance in returns. The high mean-low variance portfolios would obviously have different implications for individual and collective behaviour than the portfolios with low mean and high variance.

Given an initial portfolio and its mean-variance or risk-return characteristics households may respond to given risk in the environment through following alternative means.

- a) Household level risk adjustments
- b) Public and market risk reducing mechanisms and
- c) Communal and common property risk adjustments.

The household risk adjustments can be further analyzed at intra-household level and inter-household level. The intra-household risk adjustments include measures which a household can take recourse to by negotiations within the households. For instance, asset disposal, migration and reduction or modification of family consumption. The inter-household risk adjustment strategies include tenancy, borrowing, labour contracts, group ploughing, etc

The public risk adjustment mechanisms imply availability of drought, flood relief, insurance mechanisms, public employment programmes etc. The market based risk adjustment option include forward trading, interlocking of factor and product markets, insurance cover etc.

The communal risk adjustment strategies refer to the group based measures which require collective decision making either for utilizing or preserving private or common property resources. The pooling of resources such as bullock or implements is also part of communal risk adjustment strategies.

Once the range of risk adjustment options is known the households may modify either their perceptions or response or both by changing the discount rate or time frame used for appraising returns from each investment. Thus while discount rate captures the control household has in a given resource market the time frame may capture the certainty with which household views a particular resource stream. In fact either of the two can be used to derive risk preference. The shorter the time frame in which households (or the scientists) appraise their choices less likely it is for technology to be sustainable. Development, I have argued, is nothing but widening the decision making horizon and extending the time frame of the disadvantaged households (Gupta 1981). It is obvious that not everybody's choices can be widened at the same time and in the same proportion given limitation of resources in a developing society. It is at this stage that an eco-sociological framework has to become an eco-political framework. Constraining the choices of some while widening that of others is an institutional issue which is discussed elsewhere.<sup>11</sup>

The uncertainty of an outcome may vary differently for different households depending upon (a) previous experience with a particular enterprise/crop; (b) immediate past experience; (c) successive losses or gains; (d) accumulated deficits or surpluses in the household cashflow; (e) future expectations of returns, and (f) complementarity between other assets/enterprises and the proposed investment.

The cash flows of the households resulting from a given portfolio modified by various risk adjustment options may be in surplus, deficit or subsistence. In addition, the variability in these cash flows may be evened out over space, season, sector and social networks, The stakes of different social groups in management of ecological systems would vary in each resource market.

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11. Anil K Gupta, 1990, Politics of Articulation, Mediating Structures and Voluntarism : From 'Chauraha' to 'Chaupal', IIM, Ahmedabad, Working paper No. 894, September.

The trick is to develop a calculus in which unequal stakes of different groups in various resource systems or regimes generate a set of expectations which are equitable or appear equitable (given differences in cultural and social ways of perceiving returns) at the portfolio level of households. The fairness of these distributions cannot be estimated in my view from the individual point of view only. The group level estimation of aggregated effects of individual portfolios may generate rules that modify the conditions for use of resource, technology and institutions. Under extra-ordinary circumstances the cultural norms are also modified to accommodate geological and sociological imperatives.<sup>12</sup>

The household budget influences the choices differently than would be the case if the budget was even, that is sufficient, for subsistence, or it was in surplus that is more than subsistence. Large number of researchers have done a mistake by clubbing the deficit budget groups with the surplus ones. Sustained deficit may shift the portfolio in favour of low mean - low risk assets and in some cases low mean - high risk provided the risk is not co-variant. In some cases low mean - high risk assets can be accommodated in the portfolio also because much of the cost is transferred on to the open access or common property resources. Sheep is one such enterprise which is seldom stall fed and is characteristically maintained by some of the poorest households.

At aggregate level, shifts in the portfolios can be seen by differential growth rates of various species and varieties of crops, trees, livestock, etc. Public policy at the macro and micro level influences the portfolios through changes in the access modes, assurances (through various risk adjustment strategies) and abilities. The attitudes are also modified by the expectations of the changes in the respective subsistence in future.

The changes in the individual stakes in various resource systems feed back into the ecological conditions. Once the ecological conditions are modified, the changes in the enterprise mix becomes inevitable. It may be necessary to note here that I am not underplaying the importance of changes in the institutional conditions or the technological choices as already mentioned earlier. However, a multi stage or a multi plane analysis requires that we do not mix assumptions necessary for analysis at one plane with the assumptions relevant at another plane.

The theoretical perspectives presented in this part provide testable and refutable relationships among various variables. At the same time specific hypothesis can be generated by changing the values of different parameters in each of the perspectives.

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12.

Agarwal (1990) provides an interesting example of a village where the punishment for poaching in a common property was to offer grains to the birds standing barefoot under the sun. Such a logic cannot be analysed in the classical tradition of institutional analysis. Such sanctions cannot be justified on economic ground at all. The reciprocities extend here to such claimants of resource who may not have any vote, that is, the birds. But in the process suffering in public by standing bare-foot in the sun generates a collective responsibility. It is recognised that the moral appeal may have a longer lasting effect compared to a economic tax or fine. The public display of the punishment may also generate guilt.

The cultural norms for individual and group behaviour thus do modify the perception and response to the risks and resources. While crisis of fuelwood may generate tendency for poaching, the sanctions generated by the Institutions may safeguard, to some extent, the scarce and depletable common property resource. In Southern Bhutan we came across a case where a group of villagers had put restrictions on bringing a male bull of exotic breed lest the local breed selected over centuries was polluted (Gupta and Ura, 1990). Even today many villages in South Asia follow similar practice.



## Part II

### Operationalizing Portfolio Approach to Farming system Research and Extension

The complexity of portfolio approach understood through Articulation-Response model, 4-S and 4-A models and eco-sociological paradigm can be simplified by using methodological approaches briefly described here. The major purpose is to understand the relationship between different enterprises in an ongoing basis such that areas of intervention can be identified. It is obvious that not every area of intervention need be pursued or considered feasible. Much would depend upon the availability of technical skills with the research team (be it in a research organisation or research and action voluntary organization). In certain cases it may be perfectly justified to do research on component technologies though of course the interrelationship of that component with the other subsystems of the household economy may still need to be appreciated.

The portfolio approach requires the researcher to understand that basic issue of interest should be the survival systems and not just the enterprise systems. I have argued elsewhere how an enterprise could be viable though its interactions with the other sub systems through negative externality may make the household non viable (Gupta 1981a). The concepts and methods which are found suitable for low risk environments may not be found suitable for the high risk environments. For instance, the on-farm research methodologies developed by CIMMYT and IRRI have ignored the issue of subjective and objective dimension of risks and consequent implications for design of treatments or their modifications in the cropping system research. Likewise, the monitoring systems have also not been built upon proper appreciation of the rôle of risk in so far as the stages and functions of data collection are concerned. Methodological details are provided in my paper on "Organizing a managing poor client oriented on-farm research can tail wag the dog" (Gupta, 1987). Here I will focus on the relationship between the conceptual framework and the methodological approaches.

#### 1. Articulation Response Model and Interactive, iterative and conflictive study approach:

People do not often demand what they need and many times they do not realize the need because they have not experienced the possibility of its fulfillment given the social institutional and historical context. Identification of farmer's needs and goals thus also involves making ethical and moral assumptions. Certain needs are not recognized by us because our analytical instruments, questionnaire, checklists are based on inadequate theories. In other cases the needs are not identified because people themselves do not realize any purpose in sharing them with us. In still other cases felt needs are articulated because that is what people would assume would please the researchers. And in many villages of third world, farmer's do not want to send a visitor disappointed no matter if a little lie has to be told in a playful mood.

In the interactive, iterative and conflictive case study method it is assumed that not all questions which need to be asked in a given eco-sociological context can be anticipated in every case. No matter which theory or set of theories are used and how much experience an expert has. Therefore, need for evolving relevant questions in an iterative and interactive manner is most essential.

Further, it is only when the data collected from the households is shared back with them individually or collectively, that a household realizes why at all the researcher was asking all the questions that he or she asked. The nature and quality of data which the household then shares cannot emerge, as I have argued (Gupta 1981, 1983) from any other method. The conflict between a team of researchers about what they have written without seeing or hearing and what they have seen or heard but not written in the reports raises phenomenological questions. My experience is that these questions also help in understanding each other in a team besides generating an authentic understanding of household survival mechanisms. Sharing data back with the providers fulfills an ethical as well as scientific responsibility of a researcher (Gupta, 1983,1987).

When sharing is done collectively, it can even lead to aggregation of the individual articulation and therefore influence the prioritization of research and action agenda. Explicit acknowledgement of lessons learned by the researcher from the farmer also helps in fostering the trust that is so vital for, ascertaining portfolio dynamics. Rigorous analysis of researchers own assumptions while formulating household enquiry has often not been witnessed in various farming system research programmes. There are instances where international research Centres

have designed a questionnaire for data collection in a third world and analyzed them in their Centres without following the basic steps of testing, validating the design and feeding back the results of the questionnaire survey to the providers-farmers and even the scientists. This disease afflicts some of the top level national researchers too.

The empathy and commitment, I have found, generated by using this method builds motivation to an extraordinary degree among the researchers as well as collaborating households.

An important caution must be added here. The framework that we have described here does not accommodate rapid methods of learning. Personally I feel nothing more unsuitable for the cause of sustainable development or disadvantaged groups than using methods such as 'rapid rural appraisal' or approaches of that kind. Spending only few hours or days on problems on which we are going to spend years of effort for developing technologies or diffusing them does not appear ethically responsible and methodologically rigorous. We need emphasis on longitudinal studies. Household portfolios and their dynamics cannot be understood through a short visit of few hours or days. It is tragic that large number of NGOs and research scientists have latched themselves on to this RRA bandwagon without giving sufficient thought to its implications. Short cut learning methods invariably breed short cuts in operational systems. Organizational culture would also invariably manifest the problems arising out of the attitude of using short cuts. I can understand RRA as a reaction to the several year long surveys, analysis of which may become obsolete by the time the results were received. But at the same time to correct one mistake we must not commit a series of other mistakes. In most cases RRA has become a means of shirking sustained interactive and iterative path of learning. I have no doubt that this approach to learning about household farming systems will soon die away no matter how many millions of dollars are invested in it. May be, my paper is its first obituary <sup>13</sup>.

b) Ecological mapping, 'compare and contrast' and 4-S model:

One of the basic purposes of 4-S model is to link space, season and sector with social exchange relations. The method of ecological mapping has proved to be extremely effective in identifying niches of different enterprises. These maps can be prepared at village, block, district or state level showing on each map the boundaries of different sub units. We have to plot symbolically the regions where a particular enterprise is pursued most intensively followed by moderate or minimal level of the enterprise. Essentially it is akin to A-B-C analysis used in Operational research. <sup>14</sup> After plotting crop, livestock, trees and non farm crop enterprises on separate maps we can superimpose one map over another and see the relationship between different enterprises. The fact that niches of mustard does not overlap entirely with niche of wheat or barley provides a scientific basis for hypothesizing ecological or sociological causes of differences. These maps if prepared overtime or for good, bad and normal years highlight the dynamics of niches which expand in some years and contract in others. By comparing the conditions of ecological, agronomic or management variables in the most intense and the least intense niches, we can speculate about the reasons responsible for differential weights of different enterprises in the household portfolios in various regions. Mapping at higher level provides only an approximation of the factors underlying portfolio divergence. At micro level these maps can be prepared on plot to plot basis for the entire village. Changes in land and water use can be monitored to understand various factors which influence the range of choices and the actual scale of choice exercised by the households.

Two models are used for disentangling the economic and ecological factors. The block monitoring, conventionally followed, minimizes ecological variability and maximizes managerial variability. On the other hand household monitoring of different plots minimizes managerial variability and maximizes ecological variability.

13. I must however, caution that some times many scholars use methods involving field work over several months also under the rubric of rapid rural appraisal just because it is the in thing to do. I would condone such misclassification. In cases where experienced researchers having spent years in the field work use quick assessment methods, I have less quarrel. My quarrel is with the efforts of the aid agencies to misdirect the energies of the young scholars and NGO workers.

14. For management of inventories in a firm we try to do an A-B-C analysis so that we know which tools or components explained majority of the breakdown called as A category of components. Likewise B and C category of components are identified. The top level production manager monitors Inventory of A level components and further groups of components are monitored down below.

ty. Both the approaches when used carefully and parsimoniously provide useful approximation of the factors influencing portfolio evolution and modification over time and space.

The 'compare and contrast' method can also be used in terms of generating hypothesis for explaining inter-household differences in farming systems within a niche. For instance, within a niche of millet in a village, farmers have been using inputs or management practices to varying degrees. Some of these differences between households may arise because of the difference in the access that households have to factor and product markets or kinship networks, as discussed in the eco-sociological paradigm. But some of these could be governed by micro ecological factors or adjustments to risks and resource use options over time. Discriminant analysis of such a variability in rainfed regions has shown that variance explained by agronomic or ecological factors such as fallowing in the previous season, soil fertility index, or other topographical related factors is far more than explained by economic or sociological factors in many cases (Gupta, Patel and Shah, 1985).

c) **Lateral learning and eco-institutional framework:**

Learning from each other, whether at the household level or at the level of scientists, has remained a time tested system of social and professional discourse. We have used "lateral learning" workshops among the scientists to discover how the limitations on their access, assurances and abilities prevented either networking of methods or approaches among them. These workshops also provide a way of understanding the assumptions made by each of the scientists while using various methods for on-farm research and extension (1988, 1989).

The knowledge about farmer's own indigenous innovations was one such issue on which it was found that scientists knew far more than they have documented in the official research papers. Part of the reason could be that they did not have assurance of using this information and part could be that they did not have adequate skills. The assumption made in much of the on-farm research literature that the lack of responsiveness of the scientists to the farmers needs arise because of lack of their access to on farm research facilities may not be valid in all the cases. Providing an institutional platform where information pertaining to household survival system can be exchanged through 'lateral learning' workshops may provide to the scientists an assurance that it matters if they learn from farmers.

We have also found in the research management workshops that linkages among different disciplines cannot be forged in a sustainable manner if tried only at micro level. For instance, if the annual conference of Sorghum breeders does not include the livestock scientists, it is unlikely that the livestock related issues about fodder quality or quantity would be appreciated by an individual Sorghum breeder in an university department or research institute. Therefore, the right type of reinforcement from relevant peer group is necessary to provide the assurances to every scientist about the need for looking at interdisciplinary linkages.

The attitudes - whether of farmers or the scientists are the outcomes of the way respective access, assurance, abilities or skills have interacted. Analyzing the Institutional and organizational context in which scientists work would provide practical insights about the way interaction between the scientists and their clients need to be strengthened. The portfolio of options of the scientists thus are as important to analyze as portfolio options of the farmers. Studies have shown that if scientists dream more about the way they would tackle various administrative and finance related problems of power politics, it is futile to expect that in their waking hours such scientists would be able to achieve any major breakthrough. It is the absence of such an analysis in most donor supported farming system research programmes which make us plead for a basic theoretical departure.

### **Part III**

#### **Areas of Future Research**

Portfolio approach to farming system research implies analyzing the opportunities and constraints that disadvantaged and advantaged household have in different resource markets and cultural networks. Each one of us lives at several planes of consciousness. We perform multiple roles some of which are endemically in conflict. The model of rationality based on narrow economic utilitarian assumptions fails to capture the playful performance that people often enact while surviving. In a folk song, Parvathamma of a dry village in Shimoga district of South India asked that in whatever little they grew, should not there be a share of stray cattle, birds and ants? In other words, it appeared strange to her that someone should think of crops or agriculture as a system of survival for only human beings. It is possible that this is just a metaphorical way of suggesting the need for looking at the basic ethics of nature afresh. In this ethics the right of human beings is not superior to the rights of animals or insects or other living being. It might appear Utopian or Archaic to a western mind. Or a western educated eastern mind. But the implication is that repertoire of peasants is quite rich and replete with irreconcilable messages coded in traditional folk idiom and contemporary institutional systems.

Deprivation and sustained inability to utilize various resources desensitizes several disadvantaged social groups. In such a context the concept of 'need' should not be restricted to those which are felt and articulated. Scientists have carried and would carry in future the responsibility on their shoulders for widening the decision making horizon of the distinguished poor households. The existing portfolios are an outcome of historical socio-technical institutions which have evolved in a given ecological environment. Modification of one sub-system triggers changes in another.

The research issues in future can be divided in different disciplinary streams though keeping the focus on portfolio approach intact.

(a) Socio-Economic aspects of Portfolio analysis:

1. How do farmers arrive at various time frames for analyzing the returns from different enterprises. Do they discount an enterprise more on the basis of uncertainty or on the basis of total returns or both? How do the different family members influence discount rate for appraising each enterprise?

2. What role does culture play in intra and inter household appraisal of enterprises specific risk and return and portfolio specific risk and return?

3. Whether strategies for technology transfer can be similar for households having low average return with high fluctuations in the portfolios vis-a-vis the households who have high average return with low fluctuations. To what extent the choice of institutions, means of technology transfer and strategies of communication will vary in different ecological contexts and for different types of portfolios? (See appendix two for a discussion on the possible differences).

4. How does household portfolio get influenced through demographic, life cycle and joint family breakup over time? What are the patterns in the evolution of the portfolios and what implications can be drawn for developing technologies and disseminating them.

5. Whether the appraisal of future returns and present options is done in a significantly different way by men and women. To put in other words, do portfolio characteristics significantly differ for women headed or managed households then for the male headed or managed households? In regions with high male emigration - seasonally or permanently - would portfolio preferences differ from other regions (other things being equal)?

6. How do we generate pooled variance of the portfolio which comprises enterprises dependent for inputs on private, common and open access property right regimes?

7. Whether trade off under risk are pursued in a step function or as if on a marginalist curve? It has been suggested earlier that at high level of risk and with a danger of impairing minimum consumption severely, a household may insist on a significantly large gain before deciding to shift from one technology to another. Some others have

argued that risk averse behaviour is indifferent to land size holding and therefore whatever differences arise in choice of technology take place because of differences in the access to factor and product markets.

8. Some studies have shown that the strategies of technological change for enterprises which have a marginal weight in the portfolio cannot be same as the strategies for enterprises which have a very high weight. Is there a pattern in the relative weights of different enterprises and consequent perception and response to risk by households at cross cultures or ecological levels?

b) Organizational/Institutional:

1) The portfolio of enterprises evolved by households has to be appraised keeping in view the portfolio opportunities that scientists have. How do we establish this correspondence in public bureaucratic systems vis-a-vis market or voluntary organizations? Is it possible to hypothesize that higher the assurances in the non-work space (i.e. private life) for the scientists, greater is the probability that scientists would select portfolios with lesser assurance in the profession (i.e. research problems considered riskier/unpopular by peers)?

2. For scientists who have rural backgrounds to what extent does exist a relationship between the risks they do not face in their private farms and the risks they assume farmers also do not face?

3. Whether studies of portfolio of households be conceptualized differently in private resource markets and in common property resource markets. How do we incorporate collective choice problems for developing strategies of portfolios shifts over time and space?

4. It is well known that with increase in the inefficiency of various institutions governing availability of basic needs (such as public distribution system or public employment programme), the households may increase the weightage of such enterprise in their portfolio which can survive through access to open access resources. To what extent will such shift in the portfolios affect the sustainability of supply of inputs for such enterprises. Whether improvement of technologies for such enterprises would not further shift the portfolios in the direction that may have long term negative consequences for the household economy.

5. What are the limits to which households can shift portfolios autonomously and independently of other members of the community? Whether community portfolios can be analyzed by just aggregating the individual household portfolios knowing that there are no systematic transfer pricing system in every community? How do we therefore evaluate externalities of shift in portfolio of one group for others? For instance if credit is cheap and labour mobility is restricted. And large farmers are unwilling to pay market wages, would not pressure for mechanization increase? To what extent the consequent change in crop, livestock and tree system affect the portfolios of landless, tenants and other disadvantaged groups? Whether agenda for technological research can be properly identified without looking at linkages between macro public policy and micro level resource use options?

c) Ethical and Cultural Dimensions:

1. Development of technologies implies allocation of resources. A particular enterprise may be **class** specific in one ecological region and eco-specific in another region. How do Scientists make judgments - ethical and moral - while justifying research resource allocation for different eco-sociological contexts or

15. For instance, sweet potato in Bangladesh was found to be a survival crop for landless homestead owners and marginal producers in uplands. Whereas the same crop was grown by almost everybody - big or small in - riverine/charlands. There were differences both in the gender composition of the cultivating labour force and their preferences of different attributes of the same crop in these two regions.

problems therein?

2. The non sustainability of extreme chemical input agriculture is becoming evident in the developed world itself. In the developing countries also the dilemma is no more of just theoretical interest. At the same time, number of post graduate thesis to pursue sustainable low external input agriculture are very few. The job opportunities from the corporate world, increasing budget deficit and squeeze in public employment opportunities influence the choice of skills by the young scientists in making. The generation of technology is affected as much by the career interests of scientists if not more as by the objective needs of the households perceived by the research organizations. Has excessive emphasis on methods distracted attention from the organizational ethics and politics which may influence generation of research agenda?

3. The pastoral communities generally have lesser say in the national polity than cultivating communities. The judgment of grain as more important component of output than fodder is an indication not just of technical parameters but also of moral persuasions guiding scientists' behaviour.

4. Unwillingness or insensitivity of the research groups to share the findings of the research with the people from whom data is collected poses scientific and moral dilemma (Gupta, 1983, 1987). Validity of knowledge which has not yet been shared with people can be questioned on scientific grounds. Does ethics of not sharing information separately with disadvantaged and advantaged groups influence the articulation of needs by the people?

5. Portfolio approach is also much more organic and ecologically comprehensive in nature. It shifts focus from enterprise to households. In the eco-institutional perspective we link up household portfolios with scientists' portfolios. Can we specify precise conditions under which scientist shift their portfolios and research priorities vis-a-vis the changes in career rewards, peer approval and recognition by the farmers?

We have looked at the theory of portfolio approach to farming system research. The discussion on extension has been restricted here since it is already covered by other papers (Gupta, 1989, 1990 a and b and also see appendix two). The portfolio approach also helps in linking macro ecological conditions with micro ecological niches and their implications for choice of technology. Given the interaction among different enterprises in the portfolios of households, the inter organizational Interactions and networking strategies can also be speculated.

It is possible that this framework is inadequate to deal with certain specific cultural or ecological conditions. It is also possible that some of the functions of multi enterprise oriented farming system research are being performed more to satisfy donor curiosities than to solve problems of a specific farmer groups. If practices or methods are used without explicit theories we cannot conclude that there is no 'theory in use'. With retreat of socialistic ideology the word over, dominance of 'methods' as an ideology is understandable. The problem arises when methods emphasize individual enterprise and households excessively and ignore collective choice problems and inter-enterprise interactions in a systematic manner.

The portfolio theory presented here tries to reduce this neglect to some extent. Good methods always follow from good theories. A theory which does not work is undoubtedly a bad theory.

To what extent indigenous institutional innovations have incorporated some of the implications of the portfolio approach remains to be seen. One way to validate or invalidate framework presented here would be to look at the effective and socially responsive programmes. And see whether these programmes have evolved, autonomously and independently but through use of some of the approaches that I have presented here. Another way would be look for alternative frameworks that address various questions raised here better than I have been able to attempt in this paper. Ignoring historical knowledge traditions of a society may provide short term legitimacy and acceptance but is unlikely to trigger self renewing eco, class and culture specific enquiry.

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