2.3 GENESIS AND DEVELOPMENT OF AGRICULTURE KNOWLEDGE INFORMATION SYSTEMS (AKIS)

Havelock's (1971) conceptualization of a system of effective knowledge utilization served as the basis for structuring the relationships and interdependencies within the communication process of agricultural innovations. Nagel (1979) attempted to bring together all relevant elements involved in this process in the concept of "agricultural knowledge system". Knowledge flows were viewed from a systems point of view by him. He stated that the Agricultural knowledge system (AKIS) consisted of three major sub systems, viz., the research subsystem as the generator of knowledge, the dissemination sub-system as its transmitter and the user subsystem as its integrator into the stock of agricultural practices. According to him the proper functioning of the AKIS depended upon the solution of six functional problems, viz., need identification, generation of knowledge, operationalization, dissemination, utilization and evaluation of experiences. It was shown that six basic functions constitute separate goals towards which such organisations worked. He observed that lack of organisational structure impeded knowledge from the user sub-system as well as articulation of knowledge needs. Elliott (1987) proposed a model of the agricultural technology management system (ATMS) in which the technology sector was containing, the technology utilising system, the technology generating system and the technology transfer system. Roling (1988) replaced Elliott's 'technology sector' with Agricultural knowledge Information System (AKIS).
Engel (1987) pointed out that earlier models of the AKIS (Nagel, 1980), in which specific functions (for example, knowledge generation) were assigned to specific institutions (for example, research), must make way for new ones which allow for the fact that all major parties in the system engaged in all its major functions.

Development, exchange and utilization of agricultural technology were considered crucial ingredients in the mix of essentials for agricultural development. Conceptual frameworks used in dealing with technology development and transfer have not been elaborate or explicit to date. Hence an alternative perspective based on a systems approach - the agricultural knowledge Information System (AKIS) was conceptualized. It was observed that a typical AKIS served agriculture, in general, but specific domains also. They suggested that these may consist of the coffee industry, farmers in a certain geographic region or those utilizing a common production system such as female headed household. It was pointed out that though much could be achieved in extension science by embracing the AKIS approach, to a large extent that potential was found yet to be realized. While research is needed to be done to refine methods and accumulate comparative experience. What found also required was that major information organizations, aid agencies and others began to embrace the AKIS perspective instead of continuing to segment the AKIS into its constituent parts of research, extension, technology development, farming systems research etc., each supported by separate programmes (Roling et al. 1991). Using the AKIS perspective to define extension’s modus operandi and programs is central to more effectively providing farm families with the tools they need to increase the productivity of their resources (Zijp, 1992). It is essential to remember that AKIS is a part of a larger system prevailing at national level. According to Elliott
(1987), the agricultural knowledge and information processes must be examined at national level against the backdrop of:

(i) The policy environment, which formulated the laws and incentives that influenced agricultural performance.

(ii) Structural conditions, such as markets, inputs, the resource base, infrastructure and the structure of farming.

(iii) The political and bureaucratic structure through which various interest groups influenced the system.

(iv) The external sector, comprising donor agencies, International Agricultural Research Centres (IARCs) and/or commercial firms.

In the transfer of technology (TOT) model (Chambers, 1983) researchers developed technologies and they were transferred to extension for delivery to users. Further studies and research in this area suggested that TOT model was not appropriate in an ideal AKIS condition. The TOT model was found assuming a linear, one-way process starting with the researches and ending on the farm with an adapted innovation. It usually succeeded in delivering technology only to progressive farmers (Rolex, 1988). This model neither took care of indigenous technologies nor farmer participation in technology development.

Swanson (1986) described the analytical framework developed by the International Programme for Agricultural Knowledge Systems (INTERPAKS) to examine and assess agricultural technology systems. The four major functional
components of the analytical framework as defined by the INTERPAKS framework were:

1. **Policy**, which included those external factors that directly affected the technology system, including the utilization of technology by farmers.
2. **Technology development**, which included that part of the agricultural research system that was devoted to applied and adaptive research.
3. **Technology transfer** which was broken down into sub-functions of knowledge transfer and input transfer.
4. **Technology utilization** of farmers, with emphasis on small holders.

It was noted that although the analytical framework was developed as a macro level system wide diagnostic tool, it could be readily applied to a single community technology system. The synergic functioning of extension, research and other components of the AKIS were taken care by INTERPAKS. The one-way nature of the INTERPAKS model was defended on the basis that, although farmer initiated innovation is important, the essential process in modernization of agriculture is Science based innovation. Hence, the INTERPAKS model depicted the AKIS as a one-way linear system (Roling, 1989). However, according to Kaimowitz et al. (1989) innovations which were policy-driven were equally, if not more, important than science based technical innovations.

Pickering (1989) identified four key enabling factors in the Farmer-Extension-Research continuum. They were a) Macro policy climate; b) Government commitment to agriculture; c) Target group identification; d) Recognition of physical production potential and constraints. The process or functions of an AKIS could be said to be distributed along a science-practice
continuum (Lionberger and Chang (1981). Fine calibration of this continuum was required for the smooth flow of information. Linkage mechanisms were necessary to hold the different points in this continuum interacting with each other. McDermott (1988) described the different steps in the functioning of an AKIS working through several social processes like 1) Stock of knowledge; 2) Research; 3) Technology Development; 4) Testing; 5) Adaptation; 6) Integration; 7) Diffusion and 8) Common practice. This model connected human need with human knowledge as pointed by Nagel (1979). Either the need was solved from the stock of knowledge or super knowledge discovered a need. These were the two static states at opposite end of the technology innovation process. The functions of knowing, thinking, deciding and taking action on technological innovations was in between the rest of the functions. McDermott (1989) clearly distinguished between these "functions" and the existing institutions of research and extension. He pointed out that research often steps mid-way through the testing process. Testing is not finished until it is done in the systems in which the technology is expected to perform. At the end of the continuum, extension does not expect to start until the dissemination function.

Models of the AKIS which did not reflect some flow of information and influence from technology users to other parts of the system were misleading. This was not because of the moral principle that participation was needed if the system was to function benignly. It was because the empirical evidence from effective AKIS clearly demonstrated that user control in some form was an essential ingredient. Participants in an effective AKIS had to take the needs of users into account at each point at which information or technology is transformed or adopted (Roling, 1989).
continuum (Lionberger and Chang (1981). Fine calibration of this continuum was required for the smooth flow of information. Linkage mechanisms were necessary to hold the different points in this continuum interacting with each other. McDermott (1988) described the different steps in the functioning of an AKIS working through several social processes like 1) Stock of knowledge; 2) Research; 3) Technology Development; 4) Testing; 5) Adaptation; 6) Integration; 7) Diffusion and 8) Common practice. This model connected human need with human knowledge as pointed by Nagel (1979). Either the need was solved from the stock of knowledge or super knowledge discovered a need. These were the two static states at opposite end of the technology innovation process. The functions of knowing, thinking, deciding and taking action on technological innovations was in between the rest of the functions. McDermott (1989) clearly distinguished between these "functions" and the existing institutions of research and extension. He pointed out that research often stops mid-way through the testing process. Testing is not finished until it is done in the systems in which the technology is expected to perform. At the end of the continuum, extension does not expect to start until the dissemination function.

Models of the AKIS which did not reflect some flow of information and influence from technology users to other parts of the system were misleading. This was not because of the moral principle that participation was needed if the system was to function benignly. It was because the empirical evidence from effective AKIS clearly demonstrated that user control in some form was an essential ingredient. Participants in an effective AKIS had to take the needs of users into account at each point at which information or technology is transformed or adopted (Roling, 1989).
According to Bruce (1989) the research on Agricultural Knowledge Systems must proceed from an understanding of knowledge systems in general and of the specific knowledge system in which it was proposed to intervene. He suggested an approach which started by looking at knowledge systems as a whole, in terms of the processes by which research found its way into practice. It then traced those research utilization processes in a given system and determined the system elements and relationships from that.

2.3.1 Linkages

The lack of strong links between research and extension was always found a constraint for efficient management systems. Moreover, it was also felt that the technologies were not transferred to farmers with the required speed. In response to these problems, a new approach, the Training and Visit (T&V) system was adopted by many extension organization in third world countries (Mohamed et al. 1991). This management system evolved on a single line of command, concentration of effort, time-bound work, a field orientation, regular and continuous training and two-way linkages between extension and research (Rivera, 1990). It sought regular information flows between research stations, subject-matter specialists, extension workers, contact farmers and followers (Roling, 1989). Limitations included lack of flexibility and responsiveness, top-down approach, unfunctional linkages, centralized management (Rivera and Wheeler, 1989; Bisceo, 1991; Antholt, 1992).

Another approach to bring together farmers and researchers was through the Farming Systems Research (FSR). In the 1980’s, the generic term "Farming Systems Research” (FSR) came into common use (Byerlee et al. 1982). FSR
refers to any research that views the farm in a holistic manner and considers interaction in a farming system perspective. Later on it was termed Farming Systems Research and Development (FSR/D) (Shaner et al., 1982) and recently Farming Systems Research and Extension (Moris, 1991). The concept of target categorization (Roling, 1985) demanded that research and extension should design their programmes and output to suit the particular target categories. FSR/E attached importance to this principle and assumed that farmers were heterogenous groups and they had to be grouped into homogenous recommendation domains for the success of the programme (Moris, 1991).

Major operating principles of FSR/E were 1) Deals with technology from the farmers perspective; 2) Farmer involvement; 3) Problem-solving approach; 4) Essential component of the Technology Innovative process; 5) A part of other Systems and the other systems influenced the impact of its interventions. The limitations of FSR/E included the fact that direction may be lacking due to substantial decentralization and the absence of a true hierarchical structure (Rivera and Wheeler, 1989).

The holistic approach of the FSR/E did not mean re-designing the whole system, but seeking farmers interactions within the whole farm system. It revealed the importance of collecting information of farmers for the design as well as testing of technology. Hence, in the case of T & V as well as FSR/E, information management emerged as the most prominent factor. Hence it was imperative to seek new tools with which to manage knowledge and information. Modelling the AKIS provided with such tools (Roling, 1989). The main usefulness of the AKIS concept was found for improving the management of links between research and technology transfer.
The analysis of the interactional ties of Extension System with researchers and farmers in Andhra Pradesh (Reddy, 1986) revealed that the methods and media that provide access to the latest developments in the field of Science and Technology were poorly exposed to extension personnel right from district level headquarters to grass root village level structure. The interaction with farmers (via) farmers-oriented communication systems, however, was found tolerable. The three media: 1) Farm and Home visits; 2) Office calls; 3) Meetings were found to be quite effective for EP-FC interactions.

Malik (1988) analysed the agricultural knowledge system in Pakistan. The knowledge generation, articulation and utilization sub systems were chosen for analysis due to the similar focus they placed on the utilization of agricultural knowledge, their mutual interdependence and their complementary roles. Support service and institutions were considered to a lesser extent. A survey methodology was employed to assimilate data from different respondent groups, researchers, extension workers and farmers in the Punjab province. Findings showed that interaction and communication between researchers and extension agents and between researchers and farmers were tenuous and scarce. The extension agent farmer interactions were more frequent with a higher level of trust than between researchers and extensionists. The lack of communication was observed among those who represent different subsystems.

In a study on the linkage problem in coca technology system in Ghana it was found that the major means of information flow were the annual reports and the CRIG or CMB newsletters. But these publications were found highly irregular due to lack of funds. However, the study on maize technology system was found having inbuilt, institutionalized mechanisms through which research
A linkage mechanism is the concrete procedure, regular event, arrangement, device or channel which bridges the gap between components of a system and allows communication between them. (Roling, 1989). Barriers to interaction and understanding between scientists and extensionists, between female and male scientists between Biologists and Social Scientists as well as between farmers and Scientists were observed by Gupta (1989) also. According to Antholt (1992), while formal structures exist for communication and collaboration in many circumstances, there appeared to be real distancing between research and extension institutions. Much of the problems were due to 'turf' and traced back to the bureaucratic separation of their functions.

To enhance linkages between extension and research, five mechanisms were identified by Kaimowitz (1991). Viz. Integrate the organization, establish liaison units, organise committees for co-ordination purposes, promote joint activities and establish better communications. Van Beek (1991) formed a matrix of all the relevant research, technology transfer and user entities in the local AKIS as a tool for management of interfaces. The interfaces could be weighted according to management criteria such as frequency of use, or importance to the system as a whole. Thus, rational decisions regarding the allocation of time, attention and financial resources to each interface could be made.

Engel et al. (1991) developed the Rapid Appraisal of Agricultural Knowledge Systems (RAAKS) a tool to help managers to identify problem situations, bottlenecks to their improvement and likely actions and courses of action for improvement. This tool has already been applied effectively in 30 situations.
and extension personnel interacted and exchanged information (Annor-Frempong, 1990).

In the US, articulation (systematic inter-relation into a whole by links and messages) was observed between scientific research and technological research, between extension and farmers. The US study showed that agricultural research and extension and farmers formed a highly interlinked system (Roling, 1990; Roling and Engel, 1992).

Wagemans (1987) pointed out that the actual linkages established might turn out to be completely different from those intended in the project document, or believed to have been established by managers who rely on the 'camouflage reports' from their field staff. Murphy (1983) suggested that programme designers and researchers must understand existing farming systems in advance, which required the approach to be interdisciplinary and have a two-way information flow. He affirmed that co-ordination among researchers and development actors, from farmers to politicians was the key to success.

2.3.2 Flow of information

Since sixties extension research concentrated mainly on the interpersonal communication. Communication patterns between extension personnel and research personnel, and between farmers and extension.

Sanoria and Singh (1981) in the Intra-system analysis of agricultural extension system revealed that peer communication, opinion leadership and communication network centrally operate to a considerable degree among
extension personnel representing various sub-systems. These communication pattern indices were strongly correlated among themselves and also with the individual level and inter system communication patterns like information input, output and communication with researchers.

Babu and Sinha (1985) found considerable loss of information in the flow from information generation system to the information consumption system regarding modern rice technology.

The communication and information channels needed to ensure the effective implementation of farming systems research project in Botswana were outlined by Norman (1987). The channels involved two-way information flow systems between 1) farmers and farming systems teams; 2) farming systems teams and station-based research teams and national development/planning officers.

Magembe (1984) reviewed sources of information, information requirements and the particular problems of information flow from and to small farmers. Experience from a project among small livestock farmers in Tanzania suggested that small farmers could generate information, provided their contribution (particularly paper work) was minimal.

The transformation of knowledge was found the most crucial process taking place in the AKIS. The essence of an AKIS was that knowledge generated in one part of the system was turned into information for use in another part of the system. It was seen that few extension workers were trained to transform a technical recommendation into instructions which a farmer could follow and to
assess the demands a technical recommendation makes on a farmer's resources (Roling, 1989).

The present focus is more on a systems approach to agricultural information. Knowledge management and technology policy have an important bearing on the achievement of publically acceptable trade-offs between food security, export, equity and sustainability (Roling, 1992). Knowledge management requires a great deal of attention to differentiation, integration and coordination of the AKIS. Differentiation must ensure that different tasks are performed in the system. These might be different in an homogeneous irrigated area than in a highly divert rainfed area. Integration must ensure that different tasks are linked and mutually support each other. Coordination, finally must ensure that synergy is maintained and that the whole AKIS remains focused on its mission (Engel et al. 1991).

A factor found working in favour of Extension Science development was the growth of information technology, the application of which had led to much greater attention to, and formalization of knowledge about flows and transformations of information and knowledge between generators and utilizers (Roling, 1990). According to Roling (1988) the requirements for flow of information were identified as:

* Familiarity with target clients as a result of frequent interaction or as a result of belonging to the same community.
* Regular monitoring and evaluation of the effects of informations and their adaptation on the basis of their results.
* Systematically organised participation and influence of target clients in intervention design and extension.
2.4 INFORMATION MANAGEMENT

Jones et al., (1987) emphasised the importance of the process of matching provisions to needs in the most effective manner as an efficient feature of information management in agriculture. They identified this as a pre-requisite for developing information delivery methods for the future. The same study puts forward the concept of the 'structure' of knowledge, which denotes how the farmer's working knowledge is organized and stored, both in the context of the working environment of the farm and in the use of information in decision making.

In Agriculture Knowledge and Information System (AKIS) theory, information is considered as an interface between knowledge and the real world; and "knowledge is something between the ears, a property of the mind, which cannot be heard, seen or touched" (Roling and Engel, 1992). Without changing the definitions visualized in this knowledge could also be thought of as an interface between information and the real world (or the farming situation).

Within the various sociological and psychological factors in which individuals interact, the interface capacity depended largely on the choice of information available. As decision makers, farmers are thus free to choose from the range of information they received from different components (or even one component) of the system. In such a situation, extension did not emphasise 'behavioural change' of the individuals (or the knowers end). Extension supplemented the needs of farmers (demand activated process) by facilitating various functions such as skill development and specialized training. This gave
a new role for extension services as "facilitators of information options" rather than "behavioural changers". Many extension agents saw their task as one of improving the quality of farmers' decision making in order to help the farmers achieve their goals more satisfactorily (Van den Ban and Hawkins, 1988). Long (1984), Leeuwis, et al., (1991) and Leeuwis (1993) advocated an "actor oriented" approach rather than the AKIS approach, mainly to emphasize the social dimensions, which they criticised as deficient in the AKIS.

Long (1984) suggested that an actor oriented analysis, focused attention on important questions such as differential responses to changing circumstances shown by different social categories and groups. His concern as a sociologist is further reflected as he argued for an actor oriented analysis of social process which identified how 'ordinary people' rather than simply abstract 'social forces' actively shaped the outcomes of development. It was, therefore, at the personal level that the opportunities for fruitful co-operation between the components have the greatest potential (Arnon, 1989). In agricultural extension an "actor oriented system approach" is often practical and useful.

The goal in an information transfer system is the efficient use of information (its management) in learning and especially in decision making. The process described by Jones et al. (1987) is given in Fig. 2. The stages within the process suggested diverse roles for a farmer in decision making for example, the appraisal stage may involve experimentation and the trial involve implementation of what information was already available.

Another view of information management was given by Chambers (1993) through a "Farmer First" (FF) approach in which farmers' priorities and
Fig. 2 A conceptual framework for decision making by farmer
participation are key features. The essence of FF is a reversal of the TOT model which started with some item or items of technology. In practice, this sought the reasons for farmer's non-adoption of new technology not in the lack of information of the farmer but in deficiencies in the technology itself and the process that generated it. The significance of the reversal for learning was that researchers and extension workers learnt from farmers.

2.5 RESEARCH METHODS

Research methods have been defined as tools to answer specific questions and for solving different scientific or practical problems. It is the substance of the matter - the questions to be answered - that must guide the selection of methods - not vice versa. Methods should not become straitjacket (Mikkelsen, 1995). This contemporary definition of research methods is an outcome of the stages through which many social scientists have moved: from traditional quantitative empiricism and deductive positivism - some over historical materialism, other over systems analysis, case studies, etc. - towards qualitative, iterative and inductive research methods. The influence of grounded theory on the methodological development trend is significant. Research method, if defined as a comprehensive set of approaches to gather evidence and analyze specific problems, encompasses techniques and tools. Methodology encompasses theory and is not directly operational like method.

2.6 QUANTITATIVE AND QUALITATIVE METHODS

Controversies have raged over the justification for using qualitative methods in social science research in general and in development studies in
particular. The controversy is centred around the scientific traditions with which the two methods are associated. At the risk of over-generalization, qualitative methods are identified with phenomenological, interpretative research and quantitative methods with pure positivism. Leaving participant observation aside for a moment - social anthropology's most common field research method - the debate about qualitative methods in development studies has coincided with the debate about people's participation and participatory methods. The reference to General and Typical Characteristics of either method is described in chart 1 and chart 2 (Mikkelsen, 1995).

2.7 PARTICIPATORY RURAL APPRAISAL (PRA)

Development work and research with participatory 'paradigm', depend on RRA (Rapid Rural Appraisal) or PRA (Participatory Rural Appraisal) for effective interaction with communities. RRA and PRA came into being at a time in the late 1970's when it became increasingly difficult to ignore the possibility that there might be something fundamentally wrong with the way development had been conceptualized, planned and implemented. RRA and PRA were developed in response to the disappointments and the criticism of the assumption upon which earlier development work was based. The distinction between rapid and participatory rural appraisal, has been described by Chambers (1992) that RRA leads to learning by outsiders in a cost-effective way and PRA, on the other hand, enables rural people to unravel and analyze their own situation in ways they do not normally do, and in optimal cases to plan and act on their own premises. The most important principle in this list and which overrules all the others, is the one repeatedly referred to in PRA literature. It is the principle of the one sentence manual:

'Use your own best judgement at all times' (Mikkelsen, 1995).
### Chart 1 Qualitative and quantitative methods
"General characteristics"

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Qualitative Methods</th>
<th>Quantitative Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Structure and standardization</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Flexibility in research design</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>The work/research design</td>
<td>Often inductive</td>
<td>Primarily deductive</td>
</tr>
<tr>
<td>Assumptions about basic relationships in the real world and possibilities for changing these relationships</td>
<td>Not necessarily stable/static relationships, but dynamic and reciprocal interaction between actors: social reality is man-made and may be changed by people.</td>
<td>It is possible to identify stable/static relationship (correlations, fixed parameters) between phenomena variables. Actors may consider this stability as an obstacle to change.</td>
</tr>
<tr>
<td>Research content</td>
<td>Holistic views seen mainly from the respondents' (R's) point of interpretation</td>
<td>Fragmented or sequential views: Partial variable relationships seen mainly from the researchers (F's) point of interpretation</td>
</tr>
<tr>
<td>Researcher-Respondent (F-R) roles</td>
<td>R is subject for F in you-me two-way communication. F often combines actor and observer roles as action researcher or interactive consultant.</td>
<td>R is object for F in 'I-that' relationship. F is the distant observer/analyst in the role of observer. Possible combined with the actor role as the distant manipulator.</td>
</tr>
<tr>
<td>Dissemination of finished products (reports etc.)</td>
<td>Free prose, images, metaphors, data illustrations like interview quotations and comprised observations, qualitative cross tabulations.</td>
<td>Testing by analytical disciplinary tool, tables, key figures and diagrams.</td>
</tr>
<tr>
<td>Time spent in different phases of work</td>
<td>Least during formulation, more time used for data collection and most for analysis due to massive data masses.</td>
<td>Most during formulation, less during collection and analysis due to preceding and programming of data by EDP, etc.</td>
</tr>
</tbody>
</table>

F = Researcher  
R = Respondent
<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Qualitative Methods</th>
<th>Quantitative Methods</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nature of data</td>
<td>Data must reflect profound and holistic interpretation of specific phenomena/cases. Data must be grouped in classes, non-numerical, down-to-earth, sensitive and diversified. Focus on variations, extreme values, the particular, deviances, problematic and perspectives.</td>
<td>Data must give a representative overview over general conditions or test specific hypothesis. Data should be selective, numerical, preferably exact scales and clearly separated from a well-defined universe. Focus on frequencies, averages and distribution within a population and (partial) correlations.</td>
</tr>
<tr>
<td>Typical data collection methods</td>
<td>Participant observation, semi-structured interviews, introspection.</td>
<td>Laboratory observations, questionnaire for enquiries or structured interviews.</td>
</tr>
<tr>
<td>Formulation of questions and answers</td>
<td>Open/loosely specified questions and possible answers, possibility for specification during ch process following a rough checklist. Questions and answers are exchanged in two-way communication between F and R.</td>
<td>Closed questions (hypothesis) and answer categories to be prepared in advance. F asks, R answers.</td>
</tr>
<tr>
<td>Selection or respondents</td>
<td>Information maximization guides the selection of R: who has particular knowledge? Every R may be unique (key person).</td>
<td>Representativeness as proportion of population N. Sample selection, sample size according to assumptions about distribution in population N. Rs should be directly comparable.</td>
</tr>
<tr>
<td>Sources of error</td>
<td>When R is uninformed-or when R self-censors information or gives biased information unintentionally or strategically.</td>
<td>Statistical data loss or bias; unanswered questions and questionnaires, tendency of uniformity in answers, etc.</td>
</tr>
<tr>
<td>Decision on data relevance</td>
<td>Controlled and possibly changed in the process jointly by F and R.</td>
<td>Determined by F prior to study—possibly with some assistance from R. Intervening variables are kept outside the research situation.</td>
</tr>
<tr>
<td>Definitions of concepts</td>
<td>Concepts can be defined from the outset or at convenient times during the analysis. Definitions may appear from the context in which concepts are used. Fought definitions at the conceptual (theoretical) level often sufficient.</td>
<td>Concepts to be defined from the outset-conceptual as well as operational definitions by specification of procedures of measuring.</td>
</tr>
</tbody>
</table>

Cont............
<table>
<thead>
<tr>
<th>Timing of analysis</th>
<th>Often in parallel with data collection.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Utilization of standard methods of analysis</td>
<td>Rarely, methods of analysis are formulated during early process, tailor-made for the project.</td>
</tr>
<tr>
<td>Typical forms of analysis</td>
<td>Critical analysis and interpretation of source materials. Selection, systematizing and possibly summarizing interview transcripts and observations. Interpretation and comments.</td>
</tr>
<tr>
<td>Singular/multiple interpretations of data</td>
<td>Multiple interpretations are often regarded as a positive quality. Allows for alternative interpretations, which may indicate ambiguity, conflicts and actor cover-up in the study field.</td>
</tr>
<tr>
<td>The role of theories in the analysis</td>
<td>Existing theories are typically used only as point of departure for the analysis. Theories are further developed by forming new concepts and relations between these (induction). The contents of the new concepts are studied and illustrated. Practical application of theory is illustrated e.g. by cases.</td>
</tr>
<tr>
<td>Other quality criteria for data-analysis and alternative theory-building</td>
<td>The value of originality/new interpretation, of enhanced understanding, the value of provocation, of variation or of liberation. The value of criticism and the value of potential change and problem alleviation.</td>
</tr>
<tr>
<td>Different problems with the different forms of analysis</td>
<td>The danger of F's self projection: it is possible to read any biased view and idiosyncrasy into the rubbery data. Theory development may become a banal reification of reality. Data masses easily become enormous and confuse overview-very time-consuming analysis.</td>
</tr>
<tr>
<td>Alter data collection</td>
<td>Experimental and statistical standard methods are frequently used. Cross tabulations, correlation analysis and tests of significance on numerical data. Quantitative content analysis of interviews, classification and enumeration of different reply categories-possible crosstabulations. Singular, unambiguous interpretations are aimed for through precise operationalization of variables, accuracy in data collection, etc.; the world is arranged in one objective way. Do operationalized, empirical variable represent the theoretical definitions of concepts? (The problems of indicator variability). Is there a correspondence between measures and indicator variables which also reflect the same theoretical concept? (Objectivity test of instruments). Predictability. Representativeness, reliability, precision, significance of hypothesis verification/ falsification. Value of criticism, potential value for change perspective and problem solving.</td>
</tr>
<tr>
<td></td>
<td>oversimplifies and fragments reality. Makes real life abstract and incomprehensible for other than F. Tendency to test trivial self-evident correlations (banal knowledge production). It is lured by F's way of interpreting real life through a hyper-structured mode of data collection.</td>
</tr>
</tbody>
</table>
2.7.1 'Catalogue' of PRA methods, techniques and tools

Participatory assessments and activities are methods for creating dialogue and for collecting information. They are characterized by ingenuity and flexibility. Which methods to apply depends on the specific context. The paradox is that if PRAs are rigidly done according to fixed formulas, the whole idea of the exercise is jeopardized.

No two PRA situations are the same as the people who participate, their problems and ideas, the cultural contexts and the questions that are addressed differ. The techniques and tools of PRA include well-established social science research methods, but more importantly, a set of communication and participatory data collection techniques. PRA techniques have proved to be of much use in diagnosing specific problems and highlighting possible solutions. The PRA catalogue, outlined in detail below, reveals that although many of these methods are not exactly new, they have been adjusted to become more participatory than formerly. Data collection, analysis and communication techniques under 'Catalogue' of selected PRA methods have been described by Theis and Grady (1991), which are listed below:

1. Review of secondary sources
   - Documents, statistics, reports, books, files, aerial photos, maps
2. Direct observation
3. Key indicators
   - Local, national and global indicators
   - Objectives and performance indicators
4. Semi-structured interviews
• Key individuals
• Focus groups, homogeneous or mixed groups
• Chain of interviews, probing questions

5. Ranking and scoring
• Well-being or wealth ranking
• Scoring and ranking of options
• Matrix scoring and ranking

6. Construction and analysis of maps, models and diagrams
• Social and resource maps
• Topic and theme maps
• Census maps and models
• Transects

7. Diagramming
• Causal, linkage and flow diagramming
• Time lines, trend analysis
• Seasonal diagrams
• Activity profiles and daily routines
• Venn diagrams

8. Case studies and stories
• Life histories, oral or written stories by key people, e.g. school children

9. Drama, games and role plays

10. Possible future and scenario workshops
• Consensus, conferences and hearings

11. Triangulation
• Data triangulation
• Investigator triangulation
• Discipline triangulation
• Theory triangulation
• Methodological triangulation

12. Continuous analysis and reporting
• With or without software for analysis of quantitative and qualitative data

13. Participatory planning, budgeting, monitoring, evaluation and self-surveys
• Participation in all project cycle activities

14. Do-it-yourself
• Outsiders being taught by insiders

The PRA methods included in the catalogue are neither exclusive nor discrete and several method can be applied in the same study or project. PRA methods serve several purposes. There are PRA methods for (i) collecting data and information, (ii) analysing information, (iii) both collecting and analysing data, e.g. diagrams, and (iv) communication. PRA techniques generally serve the multiple purposes of (i) dialogue, (ii) information generation, (iii) analysis and in some cases, (iv) mobilization. The elaboration of PRA 'Catalogue' is as follows:

2.7.1.1 Review of secondary sources

No matter what our research topic is, there is almost always a wealth of information hidden in a variety of sources. Many of these are accessible with limited effort. There are two major types of sources (i) Documents: Research and other official and unofficial studies and reports on socio-cultural, political, ecological conditions, national and area-specific statistics, topical and area-specific articles from journals and newspapers, archives and files, aerial and
satellite photos and maps. (ii) Folklore: Mythological, oral tradition, local and topical stories, proverbs and poetry.

2.7.1.2 Direct observation

Observation of physical structures, social differences, behaviour, action and symbols, in solitude or with others with whom observations are discussed, provides important information for posing central questions. Observation during all phases of a study contributes information on persistence and change.

2.7.1.3 Key indicators

Local indicators: Local stakeholders' criteria for what is more and less significant, e.g. criteria for priority crops, of illness or well-being, of gender roles, are vital in problem analysis and for posing relevant questions.

National and global indicators: Since development studies are set in contexts where social groups, geographical areas, environmental zones, etc., are analyzed, ranked and compared, it is necessary to be familiar with the indicators that are applied at national and global level. Indicators for objectives, outputs, performance, etc., are inevitable tools when logical framework is applied in planning.
2.7.1.4 Semi-structured interviews

Increasingly, interviews based on written or memorized checklists take the place of or supplement large-scale structured questionnaire surveys. In semi-structured interviews (SSI) questions are open-ended. Unexpected, relevant issues are followed up with further questions or probing. Interviewees are typically key individuals, focus groups or mixed groups.

Key individuals are people anticipated to have particular insight or opinions about the topic under study. They may be ordinary people and not necessarily the specialists, the better educated, those in power or the officials. The issues to be highlighted must determine who the relevant key persons are. The key people are best identified by enquiring from different sources (Chart 3).

Focus groups, homogeneous or mixed groups, are relevant when the dynamics of the group situation is considered to provide additional useful information. A group interview with specialists may provide more and better information than could be obtained in a much more time consuming exercise of individual interviews with the same people (Chart 4).

Chains of interviews between the different key individuals, groups and specialists can be a useful sequencing of data collection. Prolong question or direct questions that lead to key issues without beating around the bush, can make the interview more dynamic.
<table>
<thead>
<tr>
<th>Develop questions, hypotheses, propositions for further testing or in-depth/comprehensive</th>
<th>Can be carried out quickly.</th>
<th>Samples of informants small, susceptible to bias caused by selection of informants.</th>
<th>3 to 4 fairly extensive (about 20 questions) key informant interviews can be carried out by one interviewer per day.</th>
<th>The interviewer must possess knowledge of the subject or problem area and minimum practical experience of the subject/problem.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Generate descriptive information for planning, preparation and decision-making</td>
<td>Flexible: respond to individual differences, situational changes, emerging ideas/information.</td>
<td>Lack of acquaintance or confidence in interviewers may cause distortions in information.</td>
<td>3 to 4 fairly extensive (about 20 questions) key informant interviews can be carried out by one interviewer per day.</td>
<td>The interviewer should also have some prior experience of key informant interviewing (social anthropologist and sociologists generally have such training).</td>
</tr>
<tr>
<td>Provide shortcut to more comprehensive data.</td>
<td>Can provide in-depth, inside information if trustful relationship is established with informants.</td>
<td>Susceptible to interviewer bias: inaccurate/distorted perception and interpretation or preconceived ideas/conceptions on the part of interviewer.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Interpretation of available quantitative data.</td>
<td>Inexpensive method of data gathering.</td>
<td>Do not (but in exceptional cases) generate quantitative data.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Objectives information purposes</td>
<td>Advantages</td>
<td>Limitations</td>
<td>Time perspective</td>
<td>Interviewer qualifications</td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>------------------</td>
<td>------------------------------------------------------------------------------------------------</td>
</tr>
<tr>
<td>Generate information, interpretation, understanding of perspectives, attitudes, behaviour, problems of beneficiaries, field workers, project staff involved in planning, implementation or evaluation of development activities.</td>
<td>Can be carried out quickly and obtain wide range of responses regarding a specific/delimited issue or problem.</td>
<td>Moderator of focus group interviews subject to risks of interviewer bias.</td>
<td>1 to 2 weeks preparation: analyze situation or topic; formulate sub-topics for interview guide; select (categories of) interviewees.</td>
<td>The interviewer/moderator must possess good theoretical and practical knowledge of problem area/situation/topic to be explored.</td>
</tr>
<tr>
<td>When ideas/hypotheses on project component/design conceived at agency level need confrontation with grassroots-level ideas and opinions (improve, change or reject ideas, hypotheses, design).</td>
<td>Economic: conducted by few persons during short field periods.</td>
<td>Formal/informal leaders may monopolize discussions, influence and tacitly direct other participants' response patterns.</td>
<td>1 day is required for conducting a session and 1 day for writing summary of session.</td>
<td>Moderator should be fluent in the language in which the session is conducted.</td>
</tr>
<tr>
<td>When behaviour/reactions of beneficiaries/local groups need to be interpreted/explained.</td>
<td>Homogeneous group composition stimulates free expression and dynamic discussion.</td>
<td>If discussion enters sensitive/intimate/personal matters which are awkward, controversial or socially disapproved, the group situation may inhibit rather than stimulate individual responses.</td>
<td>5 focus group sessions require at least 1 week for writing the report.</td>
<td>Moderator should have previous experience in conducting focus group sessions.</td>
</tr>
<tr>
<td>When reactions to project components/innovations need to be interpreted/established.</td>
<td>Stimulate new perspectives/ideas and complementary views/opinions among participants.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>When ideas/suggestions/recommendations are needed to solve particular/emerging problems.</td>
<td>Do not generate quantitative data.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
2.7.1.5 Ranking and scoring

In development studies knowledge of difference and inequality is often required. For action oriented development studies the need for comparative data and priority ranking is inevitable. One objective of development work and rafted studies is to combat unequal social relations and exploitation and to reduce poverty through the promotion of economic growth and social development.

Scoring and ranking of options e.g. by using matrices can supply information through comparisons which help to prioritize different interventions and technical solutions that are relevant to and adoptable by the recipients. Using local measures, judgements and materials such as tins, seeds and sticks contributes to demystifying the research process.

2.7.1.6 Construction and analysis of maps

Participatory mapping is used for distribution of information relating to limited physical space and settlements e.g. information on population distribution, demographic data, infrastructure, natural resources and social service distributions. Maps are drawn collectively in the sand or on paper if the map is to be saved for later monitoring, for example. The method is quick and reliable as communication between the participating group members has a corrective function.

Transects are cross-sectional maps or diagrams of an area. They are constructed as a joint exercise with local informants during walks through the area for observing, discussing and registering the endowments and problems of the area.
2.7.1.7 Diagramming

Participatory diagramming is used for (i) summarizing empirical information e.g. in timelines, as well as for (ii) summarizing analyzed information, for example in bar charts and pie charts. The idea is to let people make their own diagrams. They are more likely to use other measures than the outsider.

Timelines are rough overviews of events of significance for the history of the group or the area in question. They are simpler than diagrams showing changes over time.

Trend analyses emphasize changes in local resource endowments, cropping pattern, ecology, climate, physical and social infrastructure, settlement, population distribution, migration, wealth, quality of life etc. Causes of change are registered or kept open for further inquiry.

Seasonal diagrams indicate annual variations or variations during other relevant periods for vital factors of production and reproduction e.g. rain, labour availability, food availability or prices. Activity profiles and daily routines are made to summarize major activity trends for individuals or groups on a daily basis or over longer time periods.

Venn diagrams sometimes called chapatti diagrams after the Indian pancake-shaped bread, place circles of different sizes in symbolic relationships to each other. Venn diagrams are used to depict the participants’ sense of relations between local groups or organisations. The size of the chapattis symbolizes the different weights allocated to the groups or organizations by the participants.
2.7.1.8 Case studies and stories

Life histories, oral or written stories told by key people or by key people function as supplementary information or as in-depth case studies of households, of groups and of events. To serve as a foundation for generalizations, case studies should be rafted to a theoretical framework which in turn may be adjusted as case study results provide new evidence. The social analyst gives clear guidance to the story teller or informants on how to structure the story, if structuring is at all desired. Case studies, as the name indicates, concentrate on special cases. Generalizations from case stories must be handled with care.

2.7.1.9 Triangulation

Triangulation or multiple strategies is a method to overcome the problems that stem from studies relying upon a single theory, single method, single set of data and single investigator. In cross-disciplinary teams in particular the presence of people with different experiences should be optimized through triangulation.

There are at least five types of triangulation:

1. Data triangulation which can be divided into (i) Time triangulation: where the influence of time considered in study design e.g. using longitudinal research design (ii) Space triangulation: typical form of comparative study (iii) Person triangulation: for example comparisons of reactions at three levels of analysis (a) the individual level (b) the interactive level among groups and (c) the collective level.
(2) Investigator triangulation means that more than one person examines the same situation.

(3) Discipline triangulation means that a problem is studied by different disciplines. It optimizes the experience of the different perspectives if combined with investigator triangulation i.e. having at least two people of different disciplines study the same problem together.

(4) Theory triangulation, in which alternative or competing theories are used in any one situation.

(5) Methodological triangulation involves within-method triangulation, that is the same method used on different occasions and between-method triangulation when different methods are used in relation to the same object of study.

2.7.1.10 Continuous analysis and reporting

Participatory methods mean potential participation in all stages of a study or project, from identification of the problem to evaluation—possibly with different degrees of intensity. The processes of data analysis and interpretation are no exceptions. Continuous data analysis in the field and reporting on the spot can be done in concert with local people, if not by and for local people themselves.

2.7.1.11 Checklists

Checklists can be more or less formalized and prepared in advance. A minimum is a mental checklist of questions. It is an advantage to write down a list of key question and key probes in advance to sharpen the focus of an
interview. This may do more to help the investigator's memory than result in a very detailed checklist for the interview session itself.

2.7.1.12 Note-taking

The output of semi-structured interviews is in the first instance, notes. Good, detailed and comprehensive recording is essential. Sometimes this is easier said than done if, for example, the interview is conducted by one person only. A few guidelines are:

- Number questions and mark answers
- Assign one member of the interview team to take notes, but rotate the task.
- Design recording tools which facilitate later analysis of the collected information.
- Recording of answers to more standardized information and observable information is recommended, e.g. sex, approximate age, type of house.
- Loose-leaf notes on paper prepared for entering a file permit a more sophisticated filling system than a solid note-book.

2.7.1.13 Analysis

The purpose of qualitative inquiry is to produce findings. Collection of data is linked to the analysis, interpretation and presentation of findings. The process of data collection, in this case from semistructured interviews, is not an end in itself. Yet, there are not strict formulas for analysing qualitative data as for analysis of quantitative data originating from structured interviews. The
procedures are neither scientific nor mechanistic. In Wright Mills's phrase, qualitative analysis is intellectual craftsmanship (Mills, 1959).

There is typically no precise point at which data collection ends and analysis begins, either. In the course of gathering data, ideas emerge about analysis and interpretation appears. These ideas become part of the record of field notes. This overlapping of data collection and analysis improves both the quality of data collected and the quality of the analysis, so long as the analyst is careful not to allow these initial interpretations to distort additional data collection (Patton, 1990). This does not mean that there are no guidelines to assist in analyzing data. The shift in development paradigm towards a focus on process and iteration, holistic perspectives and people's knowledge, have fostered a great deal of methodology writing, which both legitimates and guides qualitative approaches.

Investigating by use of semi-structured interviews, analyzing and interpreting the data involve many challenges. There are no formula for determining significance, no straight forward tests for reliability and validity. There are no absolute rules except to do the very best with your full intellect to fairly represent the data and communicate what the data reveal given the purpose of the study. Despite the modesty Patton (1990) gave guidance on qualitative
analysis and interpretation and showed how the quality and credibility of qualitative analysis could be enhanced. These include reminders on:

- Focusing the analysis according to purpose
- Strategies for analyzing interviews, observations and content analysis
- Finding patterns and developing category systems in inductive analysis
- Recognizing processes and linkages in data and analyzing causes, consequences and relationship.