HOLISM AND FSR

Introduction.

FSR is part of a larger 'systems movement' which breaks away from narrow, disciplinary thinking about agricultural research and development. It provides a 'market' orientation to agricultural research through focusing on specific client groups (Fresco 1986:36; Röling 1988:30) and was, at least in part, a response to weak representation of small farmers in research and extension institutions. One can hope it will be a temporary substitute for well articulated small farmer demand. In FSR theory the complexity of small farming systems is the interdependence of components which constitute a coherent whole, and the centrality of the farmer, the human factor. While the farming systems perspective must be complete or 'whole', FSR is not a separate science, it is rather "an approach and a scientist's attitude towards agricultural research" (Stoop 1987). It is seen as important that the perspective permeates the whole agricultural research process, including discipline and commodity-oriented on-station research.

The interpretation of the term 'holistic' is probably the main source of confusion in FSR. Plucknett et al. (1987) refer to the "often fuzzy and seemingly all-embracing nature" of many FSR programs. In most the holistic approach requires that the whole farm system serves as a framework for analysis during the diagnostic stage, but in later stages only specific components, subsystems or interactions are targeted for intervention (Merrill Sands 1986; Norman et al. 1994:9). The selection of intervention points is one of the problematic areas in FSR (Van Eijk 1998:20). Ideally one works on a selection of technological constraints while maintaining the whole system perspective, which implies that the complex interactions between interdependent components are recognized and taken into account (Woolley & Tripp 1994; Anandajayasekeram 1995). The question is whether the interactions with other subsystems are really kept in mind: whether one can maintain the farming systems perspective while working within subsystems. Some programs carry FSR labels but are nothing more than on-farm experiments with no systems analysis (Brouwer & Jansen 1989).

In a holistic FSR approach one might expect horizontal as well as vertical integration: between various disciplines at the farm level and between different levels, for example, the farm and the watershed. In the end the concept 'farming systems perspective' implies "seeing things from the farmers' viewpoint" (Anandajayasekeram 1995). Although some smallholder production conditions can be simulated at research stations others such as system interactions and farmer criteria can only be properly studied under actual farming conditions, i.e., in farmer managed and farmer implemented on-farm trials (Van Leeuwen 1988). Adapted on-station research cannot replace on-farm experimentation. The systems, and therefore the farmers', perspective cannot be suspended (Norman 1994). Rhoades (1994) notes "..only farmers can bring realistic 'holism' to a research project. .. ..'technology' is only part of the story. Important political, social, and even religious concerns affect farmers, who must weigh technologies within a broader framework of 'life' " .

One major problem with the holistic aspect of FSR is the delineation of the system under study: what are the boundaries of the system? The focus on the farm often ignored important structural and macro-economic factors. In the early days 'holistic' meant a breakaway from a monocropping focus to intercropping, then to cropping systems research, subsequently crop/livestock systems and off-farm activities were included. Latterly the agricultural sector, national economy and world economy were also seen by some as parts of a holistic FSR approach. The most broadly conceived FSR programme integrates agricultural research and development strategies.

The Francophone approach to FSR is a rare example in which agrarian infrastructure and services are treated as variable (Fresco 1986; Huijsman & Budelman 1996). The definition of the boundaries of a system is a fundamental step in systems analysis. The decision which factors to treat as endogenous variables (under farmers' control) and which as exogenous parameters (not under farmers' control), is often a dilemma to researchers. FSR, which is basically a 'hard' systems theory, neglects the fact that the delimitation of systems' boundaries is a subjective process (Brouwer & Jansen 1989). Despite lip-service to holism systems thinking is still the exception rather than the rule (Sevilla Guzmán et al. 1994; Bawden 1995).

When FSR becomes more holistic, multidisciplinary and location specific, with wider roles umbrella'd under the concept the analysis becomes more relevant but brings with it far reaching consequences in terms of methodological complexity, interdisciplinary communication, skill requirements, and organization and management. Demands on institutions and personnel applying the concept rapidly increase and this raises serious doubts about its practicality. Simmonds (1985:21,84) captures this, he says: "In real life ... systems isolated for study are always subsystems arbitrarily defined for the purpose in view. They are never holistic in any serious sense of that rather over-used word. In practice, what is wanted is sufficient understanding to attain the necessary level of FSP [Farming Systems Perspective] and no more. I wish the words holism and holistic were avoided in FSR contexts except when a really deep analysis of a whole-farm system is being attempted,.. ... For OFR/FSP [On-Farm Research with a FSP] a partial, non-holistic, subsystem knowledge will suffice or, anyway, has to suffice in practice. ... FSP rightly takes a common-sensical rather than a formal view of systems and, only exceptionally, needs to make numerical models. ... A system is what an experienced worker says it is".

The systems approach concentrates on interrelations or interconnections, it is a dynamic approach that considers processes more fundamental than structures. Bawden (1995) argues that FSR is more systematic than systemic - "more concerned with the rigour and linear logic of the process, than with the systemic interconnections of either the object of the research or the process used". The capacity of FSR practitioners to think and act systemically must be improved. Sustainable development requires systemic competence, expressed in a systemic perspective which portrays "the sense of wholeness in all of this" and which promotes the participation of all relevant stakeholders in the rural development process (ibid.). Successful practitioners of systems analysis pursue it more as a 'craft' than as a science (Maini 1987).

It must be emphasized that agricultural research, and thus also FSR, is only one component in the mix of conditions that must be taken care of in order to facilitate rural development. Other components in the multi-dimensional process of rural development, such as an adequate infrastructure, input supply, credit, marketing, land tenure and price policy, are often a prerequisite to research and extension making a difference. Which components in this mix should be treated as endogenous variables and which as exogenous parameters? In the Anglophone FSR approach, the common approach in Eastern and Southern Africa, one has chosen to adapt research to the external conditions which are seen as largely given. As a practice-oriented field agronomist I support this choice: what can a resource-poor farmer or FSR agronomist do about infrastructural bottlenecks or inappropriate price policies? After all, it is unlikely that the countervailing power of resource-poor farmers rapidly will increase. At the same time, however, it is clear that infrastructural bottlenecks hamper the effectiveness of investments in agricultural research. In recent years the tendency in FSR is to treat more and more institutional factors as potential leverage points. The farming systems perspective is enlarged.

Whether the problems of implementation implied by an enlarged perspective can be solved remains to be seen. Coordination of the input of farmers, researchers, extensionists, input suppliers, credit and marketing organizations, private traders, NGOs, planners, donors, and politicians is difficult. The whole system perspective is hard to realize, yet it is evident that, in location-specific farming systems, the central position of farmers as 'experts at adaptive management' requires more attention (Holling 1995).

Four Main Issues.

A list of 15 operational problems in FSR is presented in Table 1. Virtually all these problems arose in each of my work experiences in Mozambique, Kenya, Tanzania and Zambia. Moreover, they appeared frequently in a review of FSR literature (Van Eijk 1998:94). It is evident that all problems do not necessarily emerge in each FSR programme but nevertheless most will be familiar to FSR practitioners, certainly in Eastern and Southern Africa. Some are not specific to FSR and have hampered conventional research on a continuous basis, a few are FSR specific. Many are interrelated which makes it difficult to rank them in order of importance.

The initially simple FSR methodology has been under constant revision, many innovations have been introduced: the farmer-first paradigm, PRA techniques, gender, informal research and experimentation, and so on. These are no substitute for FSR, but complement conventional procedures which are flexible enough to incorporate new techniques and methods (Anandajayasekeram 1995). Practitioners have suggested modifications to solve all the problems listed in Table 1, but these make the process so elaborate that for most, if not all, FSR teams, problems of practicality arise. Bearing in mind that much FSR is implemented by relatively junior researchers working under difficult conditions these innovations easily 'overload' FSR teams. Too elaborate definitions of FSR result in an approach that is difficult to implement by current research systems. The dilemma is to balance holistic, interdisciplinary and pragmatic approaches.

Table 1: List of operational problems in FSR (Van Eijk 1998:95)

Lack of systems perspective
Lack of client-oriented attitude
Lack of farmer participation and lack of countervailing power
Lack of participatory attitudes with researchers and extensionists
Neglect of indigenous knowledge and gender issues
Lack of feedback to On-Station Research (OSR) and weak priority setting there
Lack of collaboration FSR-OSR and weak institutionalization of FSR
Lack of involvement of extension and NGOs
Lack of ecological sustainability
Neglect of variation in time and space
Neglect of role of intuition
Lack of quality in field experimentation
Lack of balance in breadth & depth of research
Lack of incentives and resources
Lack of interdisciplinarity

This long list of operational problems implies a gap between FSR theory and practice,

apparently holistic theory is difficult to implement. Although a dichotomy between theory and practice has been inherent in the FSR approach since the beginning, it has become more pronounced in recent years with the introduction of new roles and new methods. Already in 1982 Byerlee et al. noted the following paradox: "There is a potentially serious inconsistency between our advocacy of a farming systems perspective as a holistic view of an often complex farming system and the use of research methods which are cost effective and emphasize rapid results".

It seems to me that incessant improvement of methods has sought to bridge the gap between theory and practice but the impact on the well-being of resource-poor farmers has remained limited. Although each innovation makes sense, individual team members and the team as a whole cannot cope with the added complexity. Formal training has not succeeded in providing scientists who can handle increasingly elaborate FSR methodology adequately. Multidisciplinary teams are not a sufficient answer since each member must master the farming systems perspective and gain a perception of the whole, before effective interdisciplinary communication and collaboration can occur.

I have attempted to cluster the operational problems into four main issues: holism, interdisciplinarity, attitudinal factors, and lack of countervailing power of resource-poor farmers (Van Eijk 1998:118). These four are closely interrelated. If, for example, resource-poor farmers would have more power, they could, in theory, 'enforce' a more client-oriented, interdisciplinary approach to agricultural research. Holism and interdisciplinarity are key features of FSR theory and, thus, logical points to cluster operational problems.

The problematic character of holism in FSR has already been discussed. While interdisciplinary collaboration among natural scientists in FSR teams may sometimes be problematic, the key failing is weak collaboration between natural and social scientists. Social scientists in Third World countries tend to be young and inexperienced and this makes it difficult for them to function as equal partners in multidisciplinary teams (Horton 1984). Few trained professionals in these disciplines choose work at farm level, they gravitate to planning or to academia (Stoop 1987a). These main issues of holism and interdisciplinarity are 'white spots' in FSR theory and practice. They demand fundamental conceptual innovation at a level above the fragmented agricultural sciences, and new problem-solving methods.

Attitudinal factors and lack of countervailing power are, at first sight, less obvious choices as key issues in balancing FSR theory and practice. Although regularly mentioned in recent FSR literature, they are to my mind insufficiently explicated. Pretty & Chambers (1994) advocate a new agricultural professionalism about which they remark: "Personal behavior and attitudes remain the great blind spot of agricultural research and extension. The quality and sensitivity of personal interactions are critical. ... Methodologically, a major frontier for institutional change is how first to enable individuals to change, for personal change will often have to precede as well as accompany changes in the cultures of organizations". Unfortunately, changing attitudes is another 'white spot' in FSR practice, conventional training is just not up to it. On the fourth issue the central question is how to balance the power of change agents (researchers, extensionists, etc.) and the power of resource-poor farmers.

As long as the four issues remain problematic, the gap between FSR theory and practice cannot be bridged. But the question arises of 'why' these issues exist, indeed, understanding this is the key to their solution. More training and new methods are unlikely to make a great difference, at the end of the day a more thorough examination of the causes is needed. In my view the key operational problems originate from erroneous theoretical assumptions.

Although the FSR principle is commendable, it is, unfortunately, based on a faulty theoretical paradigm.

Emergent properties and synergy.

In contemporary science three different paradigms can be distinguished: the positivist, the constructivist and the transcendentalist. Historically the positivist paradigm has underpinned most agricultural research, although the constructivist paradigm gains influence there through the introduction of participatory methods. The three paradigms can be characterized by numerous criteria, some of which are shown in Table 2 (Van Eijk 1998:124). Within the positivist paradigm we can distinguish two different belief positions: holism and reductionism (Bawden 1995). Holism refers to the belief that the world is structured in the form of coherent whole entities (systems) with each subsystem, system and suprasystem having unique characteristics or emergent properties. These emergent properties are a key concept in systems thinking: they are properties which emerge at the system level and which cannot be fully understood or predicted by studying each component separately nor by simply taking the sum total of the properties of the components (Checkland 1981; Röling 1994; Bawden 1995; Engel 1995). The whole is more than the sum of the parts - the basic tenet of holism. Since greater wholes have emergent properties "one must seek to understand the greater whole in order to understand its parts, not vice versa" (Savory 1991:30). Reductionism, on the other hand, refers to the belief that one must analyze and understand the parts in order to understand the whole.

Conventional on-station research in East Africa operates within the reductionist perspective of the positivist paradigm, while most FSR attempts to operate within the holistic perspective of the same paradigm. However, holism's central tenet is not often fulfilled in FSR. The FSR approach fits in with the historical and philosophical underpinnings of the development paradigm that, during the last 40 to 50 years, guided the way development was conceptualized, planned and implemented (Jamieson 1987). Two predecessor programmes of FSR, community development and integrated rural development, suffered the same internal contradiction as FSR: i.e., the dichotomy in theory and practice, the dilemma of how to strike a balance between a holistic and a pragmatic approach. Past integrated rural development projects attempted to be so all-encompassing that they became unmanageable (Horwith et al. 1989). Conway (1985) says the same about communal self-help projects, which he describes as exercises in social engineering.

As noted earlier, most FSR attempts to operate from a holistic position within the positivist paradigm. With the recent incorporation of participatory research approaches some FSR has moved towards the constructivist paradigm. Therefore, contemporary FSR must be positioned somewhere at the point of overlap between the positivist and constructivist paradigms. In resource-poor farming, though, there is no simple 'techno-fix' nor a simple 'participation-fix' (Scoones & Thompson 1994). Nevertheless, the gradual shift from the positivist to the constructivist paradigm is a positive development in FSR. Paradigm shifts are not a matter of replacement, but of addition and extension. The prevailing paradigm becomes a subset of the new one (Röling 1995). Notwithstanding the widespread belief in the reductionist scientific method, it is evident that a wide range of problems in the 'real world' are beyond the grasp of a complete scientific analysis (Chalmers 1990:124; Funtowicz & Ravetz 1994). The starting-point for a holistic ecology must be that nature is always more complex than we, to our best understanding, can know and that changes in our association with nature always will have unpredictable consequences (Schroevers 1984:66).

This parallels the observation that from a holistic perspective 'surprise is anticipated, but never predictable' (Bawden 1995). The disappointing impact of agricultural science on farming systems of resource-poor farmers indicates that the reductionist scientific method has not been very effective in improving these farming systems. The long list of operational problems points to a similar bleak conclusion for FSR.

Brouwer & Jansen (1990) argue that interdisciplinary collaboration in multidisciplinary teams is based on the presupposition that disciplinary knowledge is complementary and collaboration will result in a more complete view of reality. This, they say, conflicts with the basic principle in systems theory, namely that 'emergent properties' exist: the system is more than the sum of its parts. It is unclear how multidisciplinary teams handle these emergent properties. Savory (1991:30) holds a similar view when he says that "the fact that wholes have qualities not present in their parts causes the interdisciplinary approach to fail". Only by having seen the whole, can one ask the right questions about the parts. In multidisciplinary teams with various single-discipline trained specialists, or in interdisciplinary teams with generalists trained in several disciplines, the researchers look from the outside to a whole, in our case a farming system. Approaching matters from this direction leads to confusion because the whole can never be seen from the perspective of the disciplines (ibid.:33). We must reverse the arrows, and look outward from the perspective of the whole at all available knowledge from the various disciplines. Only the persons who are directly involved in, and manage, the whole, command the outward-looking perspective vital to their particular management needs (ibid.:34). This puts the farm-household members central, and underscores the importance of participatory approaches and indigenous knowledge. Nevertheless, it remains important, in my view, that also researchers (specialists and generalists) master, to the largest extent possible, the farming systems perspective. If researchers are not able to operate within a systems perspective, requests from farmers and other stakeholders for sound advice that serves the holistic view, cannot be met.

When farming systems exhibit emergent properties, these only emerge when the components of a system interact. The synergetic effect of these interactions makes the farming system more than the sum of its parts. Schiere (1995:26) remarks that the word holism does not necessarily imply a mystical sense, but he simultaneously speaks of the deeper sense of the word 'system' as a unit, i.e., an 'organism' with an irreducible integrity (ibid.:32). Positivist researchers do not speak about farms as 'organisms' but use the word 'systems', which is "a technical reference to the complexity of a biological whole" (Koepf 1989). The holistic argument that 'the whole is more than the sum of its parts' has a certain 'elusive' connotation. The emerging synergetic effect of interaction can be puzzling[1]. To my mind it is evident that the dynamic and emergent nature of interactions taking place between farmers and nature, including forces which lie beyond the interface situation itself, and between numerous other actors and their networks, puts the process of rural development beyond full human control. The question is how to reduce complexity to manageable proportions without ending up in a uni-dimensional, positivist rationalization, which violates multiple cause and effect relationships in ecosystems. In an attempt to formulate a tentative answer I hypothesize that when the transcendentalist paradigm is brought to bear on the 'manageability' of complex situations, the far too narrow, positivist and constructivist views of human agency can be extended.

[1] Capra (1996:38) gives the simple example of the taste of sugar. The emergent property 'taste of sugar' is lacking in the carbon-, hydrogen- and oxygen-atoms which constitute sugar. At the same time it is impossible to explain to a person what the taste of sugar is without having him/her actually tasting it. Even if we know how the constellation of atoms in sugar react with the atoms in our taste papals on our tongues, we still cannot explain what the taste of sugar is.

With regard to the irreducible integrity of organisms Lovelock (1979) and Margulis (1995) argue that in the Gaia hypothesis life itself creates the conditions for its own existence. The regulation of, for example, the earth's temperature and atmospheric composition are in this theory emergent properties of the system 'earth', which emerge, automatically and without any teleological plan, as a consequence of cyclical feedback mechanisms between organisms and their environment (Capra 1996:113). Maturana & Varela (1987) speak of an abstract, web-like organizational pattern, an identity, an autonomous self-organization of living organisms. In the end all living beings are composed of atoms and molecules, but they are not 'nothing other than' atoms and molecules. Only the non-material and irreducible organizational pattern makes them alive (Capra 1996:87). When an organism is dissected, this pattern is lost. Most reductionist researchers do not grasp the importance of pattern (ibid.). The non-material organizing principles that in the past used to be attributed to, for example, 'souls' (Aristotle) are now thought of in terms of 'systems properties' or 'emergent principles of organization' or 'patterns which connect' or 'organizing fields' (Sheldrake 1989:54). The question remains what these elusive (ibid.:55) principles of organization exactly are, and whether people have access to these non-material organizing principles?

The agronomic principle of input interaction can serve as a practical example of a synergetic effect: the combined effect on yield of applying several inputs jointly is greater than the sum of the effects of each applied separately. On the one hand, there is little mysterious about such interaction effects: the outcomes of these mutually reinforcing interactions can be logically explained. On the other hand, however, often unexpected synergisms occur: frequently the outcomes of interactions are not predictable, because of the large number of factors that can be involved. Evans (1993), for example, points out that the yield improvements from the last few decades are due to often unexpected synergisms between agronomy, plant breeding, fertilizers, pesticides, fungicides and herbicides (in:Holden 1994). Another (non-agricultural) example is a football team: sometimes a team performs well and the whole is more than the sum of the parts, another time performance is moderate and the team is 'just' the sum of the parts. What causes the 'magic' of holistic performance, how does effective and well-timed interaction occur, what causes the synergetic effect of interaction among players, what makes a collection of eleven individuals an eleven-headed unit, a true team, rather than an aggregate of eleven individuals? Similarly, interdisciplinarity in multidisciplinary FSR teams can emerge with the synergetic effect of interaction among team members: the team functions then as a synergic whole. The question is how to create synergy in a systematic way?

Schroevers (1984) and Van Asseldonk (1987) emphasize the importance of holism as a scientific paradigm and methodology, and not only as a general philosophy of life or an article of faith. Van Asseldonk (1987) distinguishes between holistic and reductionist generality. Holistic generality is an approach in which agriculture is seen as a 'whole' and problems are tackled in an integrated way without splitting them up in sub-problems to be covered by specialized disciplines. Reductionist generality is the multidisciplinary integration in retrospect of sub-solutions developed by specialists. It is important to know whether knowledge about the cohesion of a system can be obtained by means of integration in retrospect or by means of an integral approach: when both approaches can yield this knowledge, then the choice between reductionism and holism is no longer a fundamental issue (ibid.).

Koningsveld (1986) distinguishes in his analysis of conventional agricultural science two types of problems: problems as anomalies and problems as crisis situations.

A problem is an anomaly when it can be solved with available, time-tested conceptual means and with the standard technical approach, although sometimes first new instruments must be developed. A problem is a 'borderline' problem or crisis situation when it cannot be solved with available conceptual means, but requires a fundamental theoretical innovation of the conceptual framework of agricultural research, and a new problem-solving method. In a crisis situation the limits of the old theory become more and more visible: the problem is exceeding these limits. Koningsveld (1987) speaks of procedural integration when problems in agriculture are interpreted as anomalies, and a systems approach is used as a formal methodology (often a mathematical instrumentarium) to integrate the fragmented agricultural sciences. Such a systems approach does not add much to conceptual innovation: it is just a methodological tool to integrate parts of a whole. This is the case in most positivist 'hard' systems research, in which so far mainly technical disciplines and economics play a role. Also most FSR attempts to operate within the holistic perspective of the positivist paradigm (albeit mainly without formal modelling exercises). In practice, however, most FSR boils down to a mere linking up of a limited number of disciplines, mainly agronomy and agricultural economics: it is at best integration in retrospect of sub-solutions developed by discipline-oriented scientists, which does not yield more knowledge than the sum of the parts. Joint reports by FSR teams are often just the sum of the parts. When fundamental conceptual innovation is at stake, Koningsveld (ibid.) speaks of theoretical integration. It entails the formation of a theoretical framework at a level above the fragmented agricultural sciences in order to encompass agriculture in its totality; this should allow for an integration of the contents of the fragmented agricultural sciences. The agricultural system in its totality is more than the sum of the parts studied by the fragmented agricultural sciences, so that for an adequate study of the whole also concepts of a higher level must be developed (ibid.).

The reductionist and holistic generality, as formulated by Van Asseldonk, and Koningsveld's procedural and theoretical integration, are clarified in Diagram 1. In my view the long list of operational problems and the hitherto limited impact of FSR are signs of, what Koningsveld calls, phenomena signalling a crisis: a crisis which demands fundamental conceptual innovation and a new problem-solving method.

The Transcendentalist Paradigm.

The frequently arduous collaboration between natural and social scientists in FSR is due to the fact that most natural scientists work from the positivist perspective, while many social scientists are based in the constructivist paradigm. Each paradigm occupies its own niche, but integration of the two paradigms requires an understanding of their philosophical base, and an open-minded attitude. An emerging third paradigm, the transcendentalist paradigm, can facilitate the integration of the previous two. This encompasses the earlier paradigms in the sense that it is a hybrid of the natural and social sciences, and techniques for consciousness development. It focuses on the underlying basis of human activity, i.e., consciousness, and on a transformation of attitudes, 'the great blind spot of agricultural research and extension' according to Pretty & Chambers (1994).

The FSR experience shows that one has grossly underestimated how difficult it is to change attitudes of scientists and extensionists. When two decades of fostering interdisciplinary collaboration in (relatively small and permanent) multi-disciplinary FSR teams were rather unsuccessful, how do we then 'enforce' group synergy on social platforms with a multitude of actors of different walks of life? At higher levels of social aggregation the task will become increasingly difficult.

The holistic aspect of farming systems, their irreducible integrity, is 'intangible' in the sense that it is incomprehensible: it is beyond the discursive intellect. The number of variables that are at play in agriculture make it difficult to grasp the complexities of farming systems at the intellectual level. Conventional FSR suffers from the 'illusion of intellectual holism' (Van Eijk 1998:222). Although the development process is beyond full human control, we might increase our 'steering capacity' by a new paradigm of development that pays attention to the underlying base of the multitude of interfaces and interactions.

Earlier on I spoke of a non-material, organizational pattern that underlies organisms. The Indian philosopher Maharishi Mahesh Yogi (1968,1969) calls this organizational pattern 'the field of creative intelligence', a field that underlies all nature, including people. People have access to this field through their own consciousness, when they experience 'the field of transcendental consciousness' they are at home in the field of creative intelligence. In the view of Maharishi a level of pure or transcendental consciousness, a consciousness-as-such without any content of consciousness, exists. Through meditation techniques the mind can be trained to 'transcend' the subtlest stage of thinking until one reaches this level of pure consciousness. The 'field of transcendental consciousness' and the 'field of creative intelligence' are identical, this field is the source of 'subjective' as well as 'objective' existence. It is the basis of all creation and evolution. In the course of human history this field has been given numerous names: in theistic traditions one refers to God(s), while in nontheistic traditions one postulates, for example, a nonlocal 'Tao'.

The emergent properties of organisms that emerge as a consequence of cyclical feedback mechanisms between organisms and their environment, the autonomous self-organization of organisms, the autonomy of natural processes and their triggers and feedback, are, in my view, 'produced' by the underlying 'field of creative intelligence'. The underlying base of the multitude of interfaces and interactions among social actors, and between these actors and nature, is the field of creative intelligence or transcendental consciousness.

My hypothesis is that regular access to the field of transcendental consciousness guides attitudes and behavior in a societally and environmentally friendly direction. Regular access to this field can be obtained through, for example, meditation techniques. Extensive scientific research on the Transcendental Meditation technique shows that the individual and collective effects of TM are beneficial and societally favorable[2]. The ultimate objective of participatory approaches is synergistic performance of a multitude of actors. Synergy emerges 'when certain conditions prevail' but hitherto these conditions have not been sufficiently specified. In the perspective of the transcendentalist paradigm it is the agency of the field of transcendental consciousness that facilitates the management of the multiple aspects of sustainable development. Language-mediated interaction must be supported by consciousness-mediated interaction.

[2] The TM organization claims that the TM technique does not only affect the practitioners themselves, but also persons in their (immediate and distant) surroundings. The enhancement of the quality of individual consciousness radiates throughout society via a field effect of consciousness. The TM organization claims a *holistic* and *measurable* influence of progress. Evidence to support this claim, provided by scientific research, has been published in leading, refereed scientific journals such as *Journal of Mind and Behavior* and *Journal of Conflict Resolution*. It might be useful to indicate here that research on the effects of TM has not only been implemented by TM-affiliated organizations or institutions. Research findings have been published in dissertations at Harvard University, University of California, University of Southern California, University of Cincinnati, George Washington University, University of Colorado (all in USA), University of Würzburg (Germany), University of Amsterdam and University of Nijmegen (The Netherlands), and University of Rajasthan (India). See for numerous detailed references: Van Eijk 1998.

The process in which one systematically trains the receptivity to gain regular access to transcendental consciousness can be labelled spirituality. In order to create sustainable farming systems I recommend a sustained use of the critical intellect in combination with an experiential, non-dogmatic spirituality. A spirituality that highlights personal transformation through do-it-yourself techniques. A spirituality that refers to the original meaning of religion, i.e., religare, religio: to (re)connect (to the field of transcendental consciousness). In addition to the outward-oriented approaches of the positivist and constructivist paradigms, I recommend an inward-oriented approach which focuses on consciousness development.

REFERENCES[3]

Anandajayasekeram P. 1995. Farming Systems Research: concepts, procedures and challenges. Key note address presented at the Fourth Regional Conference of the Southern African Association for FSR-E, 2-4 October 1995, Harare, Zimbabwe.

Bawden R. 1995. On the systems dimension in FSR. Journal for Farming Systems Research-Extension, Vol.5, No.2: 1-18.

Birgegard L.E. and M. Fones-Sundell. 1987. Farming Systems Research - issues and problems of implementation. Swedish University of Agricultural Sciences, IRDC, RD Analysis Section, Issue Paper No.4, Uppsala.

Brouwer R. and K. Jansen. 1989. Critical introductory notes on farming systems research in developing Third World agriculture. Systems Practice, Vol.2, No.4.

Brouwer R. and K. Jansen. 1990. FSR: model en werkelijkheid. In: Brouwer and Jansen (Ed.). Het systeem, de som en de delen: 5 opstellen over FSR. Studium Generale-LUW. SG-paper 115, Wageningen.

Byerlee D., L. Harrington and D.L. Winkelmann. 1982. Farming Systems Research: issues in research strategy and technology design. Amer.J.Agr.Econ., 64, 897-904.

Capra F. 1996. Het levensweb. Levende organismen en systemen: verbluffend nieuw inzicht in de grote samenhang. Kosmos-Z&K Uitgevers, Utrecht, The Netherlands [Dutch translation of 'The Web of Life'].

Chalmers A. 1990. Science and its fabrication. Open University Press, Ballmoor, Buckingham.

Checkland P.B. 1981. Systems thinking, systems practice. J. Wiley & Sons, Chichester.

Conway G.R. 1985. Agricultural ecology and Farming Systems Research. In: Remenyi J.V. (ed.). Agricultural systems research for developing countries. Proc. Intern. Workshop Hawkesbury Agric. College Richmond Australia, pp.43-59.

Engel, P.G.H. 1995. Facilitating innovation: an action-oriented approach and participatory methodology to improve innovative social practice in agriculture. Wageningen Agricultural University, Ph.D. dissertation.

Evans L.T. 1993. Crop evolution, adaptation and yield. Cambridge University Press.

Fresco L.O. 1984. Issues in farming systems research. Netherlands Journal of Agricultural Science, 32, 253-61.

Fresco L.O. 1986. Cassava in shifting cultivation. A systems approach to agricultural technology development in Africa. Royal Tropical Institute, Amsterdam.

Funtowicz S.O. and J.R. Ravetz. 1994. The worth of a songbird; ecological economics as a post-normal science. Ecological Economics, 10: 197-207.

Gibbon D. 1994. Farming Systems Research/Extension: Background concepts, experience and networking. In: Dent J.B. & M.J. McGregor (Eds.). Rural and Farming Systems Analysis. European Perspectives. CAB International.

Holden J.H.W. 1994. Book review of Evans (1993). In: Outlook on Agriculture, Volume 23, Number 4. CAB.

Holling C.S. 1995. What barriers? What bridges? In: Gunderson et al. (Eds). Barriers and bridges to the renewal of ecosystems and institutions. Colombia Press, New York. pp. 3-37.

Horton D.E. 1984. Social scientists in agricultural research: lessons from the Mantaro Valley Project, Peru. IDRC-219e, Ottawa.

Horwith B.J., P.N. Windle, E.F. MacDonald, J.K. Parker, A.M. Ruby & C. Elfring. 1989. The role of technology in enhancing low resource agriculture in Africa. Agriculture and Human Values, Volume VI, Number 3, pp. 68-84.

Huijsman A. and A. Budelman. 1996. A crossroads for agricultural R&D: merging approaches on behalf of sustainable development. In: A. Budelman (Ed.). Agricultural R&D at the crossroads. Merging systems research and social actor approaches. Royal Tropical Institute, Amsterdam. pp. 9-17.

Jamieson N. 1987. The paradigmatic significance of Rapid Rural Appraisal. In: Khon Kaen University. Proceedings of the 1985 International Conference on Rapid Rural Appraisal. Rural systems research and farming systems research projects, Khon Kaen, Thailand.

Koepf H.H. 1989. The biodynamic farm. Anthroposophic Press, Hudson, New York.

Koningsveld H. 1986. Landbouwwetenschap als systeemtheorie? Landbouwkundig Tijdschrift 98, nr.12.

Koningsveld H. 1987. Fragmentatie en systeembenadering in de landbouwwetenschappen. In: Koningsveld et al. Landbouw, landbouwwetenschap en samenleving: Filosofische opstellen. Mededelingen van de vakgroepen voor sociologie, 20, Landbouwuniversiteit, Wageningen.

Lovelock J.E. 1979. Gaia: a new look at life on earth. Oxford University Press, Oxford.

[3] A part of the literature references are in Dutch. For brief summaries, in English, of the Dutch material used I refer to Van Eijk 1998.

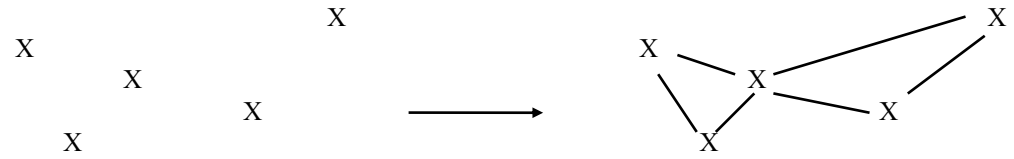
Maharishi Mahesh Yogi. 1968. Transcendental Meditation. Signet Book, New York. (Original title: The Science of Being and Art of Living, first published in 1963).
Maharishi Mahesh Yogi. 1969. On the Bhagavad-Gita. A new translation and commentary. Chapters 1-6. Penguin Books, England. (First published: 1967).
Maini J.S. 1987. Review. Session 5: Integration of crop/livestock/agroforestry and other land-use systems. In: International Agricultural Research Centers. Proceedings of the Workshop on Farming Systems Research, Feb.1986, ICRISAT, pp.100-02. ICRISAT, India.
Margulis L. 1995. 'Gaia is a tough bitch'. In: J. Brockman. The third culture. Simon & Schuster, New York.
Maturana H. and F.J. Varela. 1987. The tree of knowledge. Shambhala, Boston, MA.
Maxwell S. 1986. Farming Systems Research: Hitting a moving target. World Development, 14, 65-77.
Merrill Sands D. 1986. Farming Systems Research: clarification of terms and concepts. Expl Agric., 22, 87-104.
Merrill-Sands D., S.D. Biggs, R.J. Bingen, P.T. Ewell, J.L. McAllister and S.V. Poats. 1991. Institutional considerations in strengthening On-Farm Client-Oriented Research in national agricultural research systems: lessons from a nine-country study. Expl. Agric. (1991), volume 27; pp. 343-73.
Moore K.M. 1995. The conceptual basis for targeting farming systems: domains, zones and typologies. Journal for Farming Systems Research-Extension, Vol.5, No.2: 19-37.
Mutsaers H.J.W. 1994. Analyse van DGIS-gefinancieerde Farming Systems Research projecten in Afrika. International Agricultural Centre (IAC), Wageningen.
Norman D. 1994. The research-research interface. In: Meindertsma J.D. (Ed.). Setting research priorities. Towards effective farmer-oriented research. Royal Tropical Institute, Amsterdam. pp.32-46.
Norman D., J.D. Siebert, E. Modiakgotla, and F.D. Worman. 1994. Farming Systems Research Approach. A Primer for Eastern and Southern Africa. FAO/SIDA Farming Systems Programme, Gaborone, Botswana.
Plucknett D.L., J.L. Dillon and G.J. Vallaeys. 1987. Review of concepts of Farming Systems Research: the what, why and how. In: International Agricultural Research Centers. Proceedings of the Workshop on Farming Systems Research, Feb.1986, ICRISAT, pp.8-15. ICRISAT, India.
Pretty J. and R. Chambers. 1994. Towards a learning paradigm: new professionalism and institutions for a sustainable agriculture. In: Scoones I. & J. Thompson (Eds). Beyond farmer first. Rural people's knowledge, agricultural research and extension practice. Intermediate Technology Publications Ltd, London. pp. 182-202.
Rhoades R.E. 1994. Farmer participation in priority setting. In: Meindertsma J.D. (Ed.). Setting research priorities. Towards effective farmer-oriented research. Royal Tropical Institute, Amsterdam. pp.65-76.
Röling N. 1988. Extension science. Information systems in agricultural development. Cambridge University Press, Cambridge.
Röling N. 1994. Platforms for decision making about eco-systems. In: L.O. Fresco et al. (Eds.). Future of the land: mobilising and integrating knowledge for land use options. John Wiley and Sons Ltd, Chicester. p.386-93.
Röling N. 1995. Naar een interactieve landbouwwetenschap. Inaugurele Rede, Landbouwuniversiteit Wageningen.
Savory A. 1991. Holistic resource management. Southern Africa Edition. Gilmour Publishing, Harare, Zimbabwe (First published in 1988 by Island Press, USA).
Schiere J.B. 1995. Cattle, straw and system control. A study of straw feeding systems. Ph.D. thesis, Wageningen Agricultural University. KIT Press, Amsterdam.
Schroevers P. 1984. Inhoud en betekenis van een holistisch natuurbeeld. In: Achterberg W. and W. Zweers (red.) Milieucrisis en filosofie. Westers bewustzijn en vervreemde natuur. Ekologische Uitgeverij, Amsterdam.
Scoones I. and J. Thompson 1994. Knowledge, power and agriculture - towards a theoretical understanding. In: Scoones I. & J. Thompson (Eds). Beyond farmer first. Rural people's knowledge, agricultural research and extension practice. Intermediate Technology Publications Ltd, London. pp. 16-32.
Sevilla Guzmán E. and ISEC Team. 1994. The role of Farming Systems Research/Extension in guiding low input systems towards sustainability: an agroecological approach for Andalusia. In: Dent J.B. & M.J. McGregor (Eds.). Rural and Farming Systems Analysis. European Perspectives. CAB International.
Shaner W.W., P.F. Philipp and W.R. Schmehl. 1982. Farming Systems Research and Development. Guidelines for developing countries. Westview Press, Boulder, Colorado.
Sheldrake R. 1989. The presence of the past. Morphic resonance and the habits of nature. Vintage Books, New York.
Simmonds N.W. 1985. Farming Systems Research. A review. World Bank Technical Paper Number 43. The World Bank, Washington D.C.
Stoop W.A. 1987. Issues in implementing research with a farming systems perspective in NARS. Working

Paper No.6. ISNAR, The Hague.
Stoop W.A. 1987a. Organization and managerial implications of a Farming Systems Approach for national agricultural programs. In: International Agricultural Research Centers. Proceedings of the Workshop on Farming Systems Research, Feb.1986, ICRISAT, pp.72-6. ICRISAT, India.
Van Asseldonk J.S.O. 1987. Holisme en reductionisme in de landbouwwetenschap: Samen meer dan de som der delen. Landbouwkundig Tijdschrift 99, Nr.9.
Van Eijk A.M. 1998. Farming Systems Research and Spirituality. An analysis of the foundations of professionalism in developing sustainable farming systems. Ph.D. thesis, Wageningen Agricultural University, The Netherlands.
Van Leeuwen J. 1988. On-farm trials in Farming Systems Research. In: An introduction to Farming Systems Analysis. Department of Tropical Crop Science, Agricultural University Wageningen.
Wilson K.K., P.F. Philipp and W.W. Shaner. 1986. Socio-cultural effects on the Farming Systems Research and Development Approach. Agricultural Systems, 19, pp.83-110.
Woolley J. and R. Tripp. 1994. Priority setting tools for research groups. In: Meindertsma J.D. (Ed.). Setting research priorities. Towards effective farmer-oriented research. Royal Tropical Institute, Amsterdam. pp.47-64.

Table 2: Characterization of the positivist, constructivist and transcendentalist paradigms

	Positivist paradigm	Constructivist paradigm	Transcendentalist paradigm
keyword	- matter;	- mind;	- spirit;
methodology	- experimental testing;	- debate, interaction, communication, actor-oriented approaches;	- methods for consciousness development (e.g., meditation);
nature and role of science	- natural sciences; - science is source of innovation; - key words: explanation, control, prediction, solve problems; - scientist is problem solver; - studies consequences of human activity; - reductionist position / holistic position; - conventional on-station research, most FSR	- hybrid of natural and social sciences; - communicative interaction is source of innovation; - key words: understanding, interpretation, participation, negotiation, facilitation of individual and joint learning, improve situations; - scientist is one of the active partners in the social construction of reality, equal participant, co-learner, facilitator; - studies human activity itself; - more holistic position; - some FSR which incorporated participatory methodologies	- hybrid of sciences and techniques for consciousness development; - consciousness development facilitates innovation; - key words: participatory attitudes, facilitation of positivist- and constructivist-oriented methodologies; - equal participant, co-learner, facilitator; - studies the underlying basis of human activity; - holistic position; - research with a farming systems perspective, combination of science and spirituality
nature and role of extension	- Transfer-of-Technology (TOT), teaching - transfer of data and information; - do to, do for	- facilitation of participatory learning processes; - sharing, interpretation and transformation of data and information; - do with	- integral human development; - transformation of attitudes; - do with, do themselves

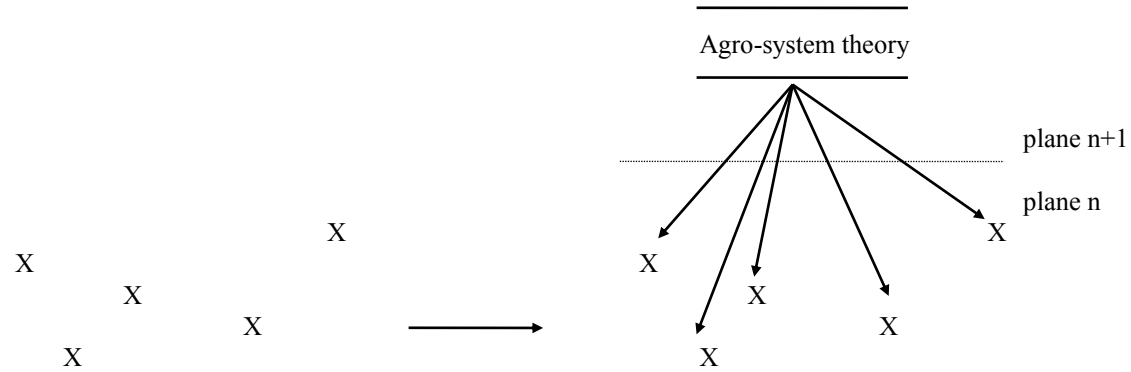
A: Procedural integration (Koningsveld 1987)
Reductionist generality (Van Asseldonk 1987)



the fragmented agricultural sciences
plane n

integration in retrospect
plane n

B: Theoretical integration
Holistic generality



the fragmented agricultural sciences
plane n

integral approach
fundamental conceptual innovation

Diagram 1: Holism in agricultural science
In situation A, at best, integration in retrospect of sub-solutions developed by discipline-oriented specialists takes place. In situation B a new theory about the system agriculture, at a level above the fragmented agricultural sciences, is developed.