RESEARCHING WITH FARMERS

A study of KARI participatory research practices in context

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Dit onderzoek is uitgevoerd binnen de CERES Research School for Resource Studies for Development

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Proefschrift
Ter verkrijging van de graad van doctor
Op gezag van de rector magnificus
van Wageningen Universiteit,
Prof. Dr. M. J. Kropff
in het openbaar te verdedigen
op woensdag 25 oktober 2007
des morgens om 11.00 uur in de Aula

Kamau, G. (2007)

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ISBN: 978-90-8504-760-5

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ABBREVIATIONS AND ACRONYMS

AA	Administrative Assistant
AD	Assistant Director
AEZ	Agro ecological Zone
AIDS	Acquired Immune Deficiency Syndrome
ANT	Actor Network Theory
AOB	Any Other Business
ASAL	Arid and Semi Arid Lands
ASK	Agricultural Society of Kenya
ATIRI	Agricultural Technologies and Information Response Initiative
AU	Australian
AYT	Advanced Yield trials
BOM	Board of Management
CAP	Community Action Plan
CBO	Community Based Organization
CD	Centre Director
CEB	Coordinated Ecosystem Breeding
CGIAR	Consortium Group of International Agricultural Research
CIMMYT	International Maize and Wheat improvement Centre
CIP	International Potato Centre
CRAC	Centre Research Advisory Committee
CRO	Chief Research Officer
CS	Commodity Station
DAC	District Agricultural Committee
DAEO	Divisional Agricultural Extension Officer
DAP	Days After Planting
DAP	Diammonium Phosphate
DCD	Deputy Centre Director
DD	Deputy Director
DD R&T	Deputy Director Research and Technology
DD F&A	Deputy Director Finance and Administration
DFID	Department for International Development
DFRD	District Focus For Rural Development
DFST	District Farming Systems Team
DGIS	Directorate General for Development Cooperation (The Netherlands)
DOA	Department of Agriculture
EAAFFRO	East African Agricultural and Forestry Research Organization
EAC	East African Community
EACSO	East African Common Services
EAVRO	East African Veterinary Research Organization
EASB	European Agricultural Settlement Board
ECA	East and Central Africa
ECD	Embu Catholic Diocese
EM	Effective Microorganisms
EMB	Embu
EMCO	Embu Maize Composite

EPHTFCP	Eastern Province Horticultural and Traditional food Crops Project
EPR	External Project Review
ERS	Economic Recovery Strategy
FAO	Food and agriculture organization
FEW	Frontline Extension Worker
FF	Farmer First
FFL	Farmer First and Last
FBK	Farmer Back to Farmer
FFS	Farmer Field School
FIPS	Farm Input Promotion Services
FMR	Farm Management Research
FOG	Farmer Organized Group
FPR	Farmer Participatory Research
FRG	Farmer Research Group
FSARET	Farming Systems Approach to Research Extension and Training
FSR	Farming Systems research
GDP	Gross Domestic Product
GEF	Global Environment Facility
GIS	General Investigation station
GLM	Green Legume manures
GM	Green Manure
GSU	General Service Unit
GOK	Government of Kenya
GRT	Green Revolution Technologies
HCDA	Horticultural Crops Development Authority
HQ	Head Quarters
HIC	Horticultural and Industrial Crops
HYV	High Yielding Varieties
IARCs	International Agricultural Research Centres
ICRAF	International Centre for Research in Agroforestry
ICRISAT	International Centre for Research Institute for the Semi Arid Tropics
IDS	Information and Documentation Services
IFAD	International Fund for Agricultural Development
IITA	International Institute for Tropical Agriculture
ILRI	International Livestock Institute
IRMA	Insect Resistant Maize for Africa
ITK	Indigenous Technical Knowledge
JK	Jua Kali
KANU	Kenya African National Union
KAPP	Kenya Agricultural Productivity Project
KARI	Kenya Agricultural Research Institute
KBC	KARI Biennial Conference
KEFRI	Kenya Forestry Research Institute
KIT	Royal Tropical Institute
KNA	Kenya National Archives
KRG	Kirinyaga

KU	Kenyatta University
LAN	Local Area Network
FG	Function Groups
LNC	Local Native Council
LVEMP	Lake Victoria Environmental Management Programme
MDG	Millenium Development Goals
MGR	Merry Go Round
MO	Memorandum of Understanding
MOA	Ministry of Agriculture
MOALDM	Ministry of Agriculture and Livestock Development
MPTs	Multi Purpose Trees
MRG	Muranga
MRIS	Mwea Rice Irrigation Scheme
MRST	Ministry of research Science and Technology
MTIP 3	Medium Term Implementation Plan 3
MTIP III	Medium Term Implementation Plan phase three
MTIP IV	Medium Term Implementation Plan phase four
MTP4	Medium Term Implementation Plan 4
NARL	National Agricultural Research Laboratories
NARP 1	National Agricultural Research Project Phase 1
NARP 2	National Agricultural Research Project Phase 2
NARS	National Agricultural Research System
ODI	Overseas Development Institute
NCST	National Council for Science and Technology
NFCC	National Farming Systems coordination Committee
NFRC	National Fibre Research Centre
NGO	Non Governmental Organization
NHRC	National Horticultural Research Centre
NIB	National Irrigation Board
NICA	Non Denominational International Church of Africa
NPT	National Performance Trials
NRC	National Research Centre
NRELC	National Research and Extension Liaison Centre
NSC	National Steering Committee
OED	Oxford English Dictionary
OFR	On Farm Research
OFR/FSP	On Farm Research /Farming Systems Perspective
OM	Organic Matter
OPV	Open Pollinated Variety
PC	Programme Coordinator
PCD	Percentage Crop Damage
PD	Participatory Diagnosis
PLAR	Participatory Learning and Action Research
PPB	Participatory Plant Breeding
PR	Participatory Research
PRA	Participatory Rural Appraisal

PRA	Participatory Rural Appraisal
PSV	Public Service Vehicle
PTD	Participatory Technology Development
PWC	Percentage Weed Control
QPM	Quality Protein Maize
RCC	Research Coordination Committee
RELD	Research Extension Liaison Division
RF	Rockefeller Foundation
RGS	Royal Geographical Society
RO	Research Officer
RRA	Rapid Rural Appraisal
RRC	Regional Research Centre
RREAC	Regional Research and Extension Advisory Committee
RPK	Rural Peoples Knowledge
RS	Research station
RSC	Regional Steering Committee
SACCO	Savings and Credit Cooperative Organization
SAO	Senior Agricultural Research Officer
SC	Sub Centre
SHD	Small Holder Dairy (project)
SIDA	Swedish International Development Agency
SL	Scotts Laboratories
SMP	Soil Management Project
SMS	Subject Matter Specialists
SP	Strategic plan
SRA	Strategy for revitalization of Agriculture
SRD	Scientific Research Division
SWOT	Strength Weaknesses Opportunity and Threats
T&V	Training and Visits
TA	Technical Assistant
TC	Tissue Culture
TO	Technical Officer
TOT	Transfer of technology
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development programme
UON	University of Nairobi
USAID	United States of America International Development
WB	World Bank
WWI	World War 1
WWII	World War II

Acknowledgements

This PhD study was made possible by research funds from the Rockefeller foundation Scholarship through the PAU programme for which I am deeply thankful. The study leave granted by my employer Kenya Agricultural Research Institute and the assistance from various departments in the institute are all gratefully acknowledged. I especially thank the numerous staff members who spared time to respond to my many questions and discussions. I also thank the many farmers who shared with me their very rich experiences as well as the pupils and teachers of the various schools. This study would have been impossible without you and for this I am profoundly thankful.

The Technology and Agrarian Development group through the PAU programme coordinated by Dr Conny Almekinders provided the logistics and the guidance necessary to accomplish my studies for which I am very thankful. I will always cherish the continuous encouragement and mentorship despite your tight and often difficult task of piloting the programme from scratch. It required a person with your determination to steer the ship.
I thankfully appreciate the invaluable support from various staff members of the TAD group. I particularly thank my promoter Prof. Paul Richards whose academic guidance as well as his wealth of experience and his oratory skills in conveying the same always intrigued and encouraged me. I also thank my co-promoters Dr Conny Almekinders and Dr Paul Hebinck who tirelessly listened to my arguments and critiqued my numerous drafts and provided the guidance that I needed throughout my work. I have always wondered how they managed to spare that moment even at short notice to sit with me and comb the drafts to finalize the thesis amidst all their work. I profoundly thank you for your time and patience as you guided and cheered me on. *'Asanteni sana'*. My thanks also go to my field supervisor Dr Regina Karega who always had a word of advice and encouragement despite her tight administrative, teaching and supervision schedule at Kenyatta University. I also thank Femke van der Lee for the layout and formatting of the thesis.

I could not have coped with my studies without the administrative support first from Dini Pieterse and then Inge Ruisch in the TAD office. You shouldered my administrative burdens and organized my travel to and from the Netherlands and other necessities as and when I required them for which I am very thankful. I thank my PAU mates in the various cohorts and particularly my Cohort 1 trail blazers –Prossy, Bud, Lanying, Paco, Christoph who

'wiped the dew' for the rest. Friends, I say '*asanteni sana*' (thank you very much) for all our academic and social interaction and may the PAU spirit forever remain alive. Many other colleagues especially the African students provided an atmosphere of home away from home. Friends you were always there whenever my steam ran out and for this is I am gratefully indebted.

My studies would not have been possible without my dear parents Samuel Kamau and Millicent Muthoni who took me to school and saw me through my tender years and provided all I needed and continue being a source of inspiration. Thank you so much for all your support. Finally the marvellous support from my dear wife Lilian, our daughters Millicent, Ruth, Julia and son Samuel is an experience I will always cherish. You were always a telephone call, text or email message away and during my field work, your cheerful conversation and interest in what I was doing always spurred me on and to you I dedicate this thesis.

CHAPTER 1

RESEARCHING RESEARCH: BACKGROUND AND DEFINITION OF ISSUES

1. The context

Many Sub-Saharan African countries were food[1] self-sufficient prior to the 1970s but a combination of factors has led to a decline in food production and a growing
reliance on food imports and food aid, with concomitant increases in poverty and civil strife. A reversal to enhance future food security, peace and health is called for (Jayne 2004). The requirement is especially pressing given that Africa's current population is expected to rise to about 1.3 billion by 2020, with even greater pressure on an already precarious food situation. The challenge is how to increase food supply to match both overall population growth and rising urban demand. The problem is compounded by the difficulty of generating well adapted agricultural technologies amidst a series of challenges that quickly impact negatively on any productivity gains (Lynam et al. 2005). The main challenges include unreliable rainfall, weak research and extension policies, severe pest and disease problems, poor macroeconomic policies, an underdeveloped resource base, and under-investment in transport and marketing infrastructure.

The above scenario is real, even as technological progress increasingly becomes the principal basis for competitiveness in a world market economy, unlike in the past, when African countries enjoyed a comparative advantage for at least some tropical commodities, based on factor and agricultural endowment. As argued by Hebinck and van der Ploeg (1997), integration of farmers into modern markets, the continued spread of technology, and institutional change are inevitable, continuous and desirable, whereas failure to adapt to such changes may lead to marginalisation, as illustrated by a decline in African global exports from 6% in 1990 to 2% in 2002 (UNCTAD 2003). Following the challenges facing African agricultural production, some neo-industrialist arguments have emerged, claiming that development in Africa should by-pass the agricultural sector and jump-start urban informal and industrial sectors (Ellis 1999). Such arguments, however, disregard the critical role of increased agricultural productivity as a key boost to economic growth in the industrial and service sectors. As borne out by the demographics, rural population accounts for up to 80% of the population of many African countries, with a

[1] Food in this case refers to the staple crops predominantly produced by the smallholder farmers.

majority directly or indirectly deriving their livelihood from agriculture or agriculturally related enterprises. These numbers require a research system to clearly articulate mechanisms to focus on the food and income needs of this large agricultural producer constituency and this situation is often reflected in various government policy documents and development plans.

The African agricultural research system has a major role to play in the mitigation of the food crisis, as well as in enhancing the sector contribution to other livelihood demands. A combination of increase in land and capital productivity is a precondition for a projected 4% annual growth in African agricultural GDP to raise rural areas from deep poverty. To meet such a growth target a revitalisation of scientific initiative focused on agricultural productivity gains is critical. The necessary technology development will require an interactive process linking farm level diagnosis of constraints and scientific understanding and analysis focused on resolving these constraints (Odhiambo 1967, Jayne et al. 2002). According to Chema et al. (2003), the structuring and organisation of African agricultural research institutions and the linkage they achieve between global science innovators and rural development practitioners will be the key determinant of the effectiveness of an African agricultural transformation. Arriving at this goal, however, remains a major challenge in most African countries, and not least in the country with which this thesis is specifically concerned, namely Kenya.

Owing to a colonial legacy in many African countries, including economic reliance on commercial export agriculture for tax revenue, much public sector research emphasis has been placed in the past on commercial export agriculture. This has resulted in the drowning out of the voices and needs of smallholder and subsistence farmers, despite their predominance in the demographics of most Sub-Saharan African countries. The situation has been made worse by the dominance of the (so-called) linear model of technology generation and transfer over the past half century, with its accompanying inherent assumptions about fixed roles assigned to various actors involved. In the linear model, agricultural professionals determine what constitutes a (presumed) improved technology for farmers to use. The inherent assumption in the model is that farmers should necessarily adopt improved technologies where these are so designated by experts, with no room allocated for user information and ideas about design or application.

The adoption success in Asia and Latin America of the Green Revolution (GR) high yielding dwarf wheat and rice varieties, and their subsequent longer-term favourable impact on food availability further entrenched the perception that

(external) experts know best. The seeds of these high-yielding varieties, packaged with fertilizers, pesticides and expert advice, were distributed on the assumption that they were scale neutral. They were assumed to be the major answer to the world's problems of hunger and increasing populations. However, they were not equally applicable in all areas of the world, and particularly in Africa with a highly heterogeneous bio-physical, socio-cultural and economic environment the Green Revolution band-wagon came to a halt.

The GR approach failed to recognise that - as argued by Drinkwater (1994) - agricultural reality bubbles with change, disorder and multiple social processes at the same time and place, with perhaps different elements moving in different directions at the same time. The GR also failed to recognise that technologies work (or not) according to how they become embedded within existing (or new) socio-technical networks, rather than because of their intrinsic properties as tools or devices (Mango 2002). Agrarian science professionals also failed to see themselves as social actors within a much wider nexus of practices, cultures and biophysical contexts, preferring to regard themselves as a caste apart.

Through such failure, they continued in their quest to organise agriculture according to models designed within closed social world of agricultural science based on assumptions about how farming ought to be, resulting (according to van der Ploeg and Long 1994) in the 'scientization' of agriculture. While this has been a major impetus in the modernisation of agriculture, it can also be argued that science practice should be more open-ended in its outcomes, based on questioning whether science is always rational and value free, and representative in any straightforward sense of a greater reality. The notion of science as an arbiter rather than servant of development stems from modernisation theories which, assumed that good farming is the version that is always highly productive, technology and market driven. In this kind of argument, the knowledge and practice of land-users is lumped together under labels like 'traditional', 'primitive' or 'superfluous' since these knowledge or skill sets do not fit readily within conventional models of transformation (Scoones and Thompson 1994).

As argued by Richards (1989, 1993) researchers think ''out of real time'' and have the luxury of controlled experiments, while farmers think ''in real time'', linked to ongoing, unavoidable and unstoppable processes in particular agro-ecological and socio-cultural contexts, and take action based on local knowledge, including comprehension of the processes and continuities within diverse environmental contexts requiring manipulation in the course of production. This then results in farmers and researchers having different theories of practice (praxis), e.g. the former rely upon interpretation of

spontaneous variation, unlike in conventional scientific experimentation where variability is screened out and results are standardised, averaged and aggregated to fit a statistically valid normal distribution (Scoones and Thomson 1994, Stolzenbach 1994).

Farmer experimentation involves both continuous and keen observation, and comparison and deduction that may be deliberate or fortuitous, as demonstrated from a study of rice farmers in Sierra Leone (Richards 1994). Scientist's experiments and trials - even when planted in farmers' fields – are rather different, in rigorously excluding fortuitous elements. Formal experiments impose a fixed research protocol, and often limit data collection to specific times of the season, thus missing out on spontaneous occurrences (Stolzenbach 1994, Richards 1994). However, field trials in farmers' fields play an important role in serving as an interface between research and farmer practice from which two-way feedback and learning may take place. This can be an important step towards improving technologies and initiating or sustaining dialogue between scientists and farmers. This scenario of two-way communication in many cases remains far from being achieved; both sets of actors remain confined to their own life worlds, reading from their own scripts.

While Green Revolution technologies have contributed to the livelihoods of farmers in better favoured environments (e.g. Southeast Asian wetlands), it is important to remember that contexts have changed over time. As Hebinck (2001) has argued, there are technological changes that emerge from within, and others that emerge from below (or what I refer to in this thesis as counter-tendency technologies). The latter can be identified in relation to the notion of niche, as proposed by Rip and Kemp (1998), i.e. defined in terms of the level at which new alternative technologies are developed. Such alternatives may result in emergence of new technological regimes, while in other cases a coexistence with predominant regimes may take place. Such niches may then challenge the predominant regime, with a key set of variables defining the differences between regimes and niches being the kinds of social processes involved.

As illustrated in the next section, an important role has been and continues to be played by agrarian science and practice, but systematic empirical findings rather than normative ideas and ideals ought to guide this practice, to avoid the shortfalls earlier experienced. This is particularly the case in areas of high environmental heterogeneity, while not excepting biophysically homogeneous areas in which other sources of heterogeneity are encountered due to a range of dynamic socio-economic factors interacting.

The Green Revolution – 'Overflowing option baskets but empty granaries?'

It would be helpful at this point to examine a concrete example of agrarian technological change, as encountered in the country focused upon in the present thesis. A phenomenal adoption rate and high rate of return was recorded in Kenya for maize hybrids in favourable maize growing ecologies, and their success attracted interest from economists. Gerhart (1975) described the initial success of the hybrids in Western Kenya, while Karanja (1990) demonstrated a high rate of return to hybrid maize investment. Hassan et al. (1998b) showed a high level of adoption of hybrid maize in the high potential areas, as compared to the low potential areas, and attributed this to various reasons, among which were seed accessibility, credit availability and farm size. These findings agreed with other studies that new technologies generated by agricultural researchers had a great potential to improve agricultural sector performance, and hence contribute positively to the welfare of Sub-Saharan African populations, as instanced in high rates of return to investment (Maredia et al. 2000, Byerlee and Eicher 1997).

But success was hard to repeat in less favourable ecologies. Low adoption rates of improved technologies characterised these less favourable areas, and for long this was blamed on the farmers, who were considered traditional or too backward to accept new ideas readily. It was then later realised that low adoption of innovations was not due to farmers' ignorance but to the frequent inappropriateness of established technologies to actual farming conditions experienced by low-resource farmers (Werner 1993).

Failure to recognise the role of potential users affects the utility of so called ''universal knowledge'', as pointed out by Salas (1994). A consequent lack of a sense of ownership affected the fate of the potato ideotype documented by Rhoades (1984). Much of the problem lies in a failure to consider the institutional and socio-cultural contexts in which the technologies are applied (Hebinck 2001). An example is the development of improved varieties of crops for planting in pure stands, while farmers continue growing a variety of crops in the same plot to mitigate risk (Jones et al. 2001, ECA 2003). Recognising this situation, plant breeders sometimes aspire to develop crops for use in specific inter-cropping designs, but this only uncovers a deeper layer of context often not fully grasped by the breeder. As Richards (1989) argues, a crop mix is a result, not a design. It is the outcome of a sequence of adaptive decisions, not a specific attempt to match types in a field. Reconstruction of the sequence of the events leading to the result may be the only way to interpret the performance, and thus avoid conflating plan with performance. Plans can be implemented, but performances have to be enacted. The help required by a farmer to improve

performance may be different from the help needed to implement a superior design. An old seed with timely application of credit may yield better than a new seed dependent on expensive and thus unaffordable chemical supports.

Increasing frustration with the kinds of technologies available to small farmers in low-resource environments led to the recognition that agricultural professionals needed to learn more about the actual agricultural practices of smallholder farmers (i.e. how farming was enacted in real time). In Kenya, such needs were expressed, for example, by a director of agriculture in Kenya as early as the 1950s, in calling for a better knowledge of the farming systems in the African native reserves before attempting to offer extension advice, thus ''avoid[ing] putting the cart before the horse'' (Brown 1968). Other efforts along these lines in the colonial period have been reported in Richards (1979) and Brouwer and Jansen (1989), and included inputs from anthropologists such as De Vries in Java, de Schlippe in the Belgian Congo and the Sudan, Audrey Richards in Northern Rhodesia and Polly Hill in Gold Coast (Ghana). These studies often had a more academic character than the development oriented farming systems research of the 1970s (Fresco 1984). All these professionals came up with findings suggesting a wealth of contextualised local knowledge to be tapped by the agro-technical sciences, and that local farmers were adept at applying this local knowledge to their own immediate farming activities and circumstances (Byerlee et al. 1982). As van der Ploeg (1989) argues, farmers understanding of agricultural processes are a complex of personal, metaphorical and contextual knowledge which becomes almost impenetrable when subjected to less painstaking forms of scientific scrutiny. It is a matter of regret that the painstaking work of colonial anthropologists and agronomists such as Polly Hill and Pierre de Schlippe tended to be pushed aside in the rush for rapid development from the 1970s onwards. As Richards (1985) has argued, regaining the analytical starting point of research on African agriculture the 1940s and '50s may still remain an important objective for agro-technical research half a century later.

Top-down transfer of technology aimed at high and rapid returns to land and capital continued, in spite of evidence about the need for knowledge 'from below', and disappointing adoption rates continued until the mid 1970s when, according to Okali, Sumberg and Farrington (1994), attention began to shift towards an analysis of the farm family and its aspirations, to gain a better understanding of farming systems, as this was considered essential for the successful development of new technologies. Following this realisation, farming systems research (FSR) was introduced into Kenya, and other African countries,

with mixed results and experiences (Collinson 2000, 1982, Shaner 1982, Gilbert et al. 1980, Norman 1978).

Farming systems research in perspective

Many FSR pioneers were economists with a farm management background who viewed small-scale farming problems from the viewpoint of theoretical models of farm management research (FMR) (Norman 2000c). In the course of using these models, no relevant technologies were identified but instead, unexpected insights into the rationality of farmers' management systems were gained pertaining to practices and allocation of resources within the farmers' production constraints. This led to greater respect for the role of farmers in evaluating technologies and undermined confidence in traditional FMR tools of analysis (e.g. linear programming). Progress towards identification of relevant technologies only occurred when trials were first implemented on farmer's fields with the non-experimental variables reflecting farmers' practices, and when farmers' criteria were used in the evaluation process (ibid)

The above is what laid the foundations of the kind of farming systems research later introduced into Kenyan agricultural research. Farming systems research dominated the agricultural research debate in the '80s, and was seen as panacea or highway to changing the lives of small farmers in developing countries. It was perceived to permit researchers to intensively investigate the individual conditions of small holder farmers and make an impact on large number of farmers through extrapolation of results to areas with similar conditions or recommendation domains (Shaner et al. 1982). There was also emphasis on understanding smallholder production conditions and systems, and hence an emphasis on systems analysis and on modelling farmers' constraints as extrapolated by researchers based, where possible, on farmers' views.

A farming system was thus taken to imply all forms of natural resource utilisation and combinations, as implemented by farmers in a stable way, in a given environmental setting to maximise attainment of goals and desired objectives (Okigbo 1979, Norman 1983b). The combined resources comprised of land, labour, capital and management of farm and off-farm enterprises. Also taken into consideration were the activities of a family unit or community group, where some or all the members of the unit participated in part or full time farm work. This unit was conceived to be a decision-making unit in the transformation of land, resources capital and knowledge into useful products to be consumed, sold or both. FSR researchers deemed a structural analysis of the farming systems of a local community to be required in order to understand

and address the adaptation processes associated with different types of farmers in a given agro-ecosystem.

This kind of analysis involved the definition of the spatio-temporal scale at which the system and its subsystem operated, and required identification of existing major problems and their potential solution. Through such research it was expected that better knowledge of the farmers' environment, resources, constraints and opportunities would be gained. This would then lead to a new working relationship between farmers and technical and social scientists would be created.

Diverse approaches to FSR have been documented, but the form most widely applied in international and national agricultural research centres is one developed by the International Maize & Wheat Improvement Centre (CIMMYT) based in Mexico. The CIMMYT format was adopted by the Kenya Agricultural Research Institute (KARI) – the national research system focused upon in this thesis - and, as will be shown later, a series of illuminating controversies surrounded its institutionalisation.

Various authors (e.g. Farrington and Martin 1988) have characterised FSR as a 'problem solving' approach, implemented by multidisciplinary teams, with a degree of farmer participation within a holistic farming systems frame. Homogeneous groups of farmers within a specific agro-climatic zone are construed as the clients of such research. The approach has also been viewed as a dynamic, iterative exercise, in which one years trials results would generate hypotheses for testing in the next season, while at the same time influencing on-station research priorities. Tripp (1982) argued that trial design in this approach was the researchers' responsibility while the farmer managed the field operations. Harwood (1979) writing on the same aspect argued for an approach with major emphasis on production planned and conducted by and with farmers on their own fields, and with flexibility and local adaptation being seen as success factors. He argued for a logical sequence of steps from selection of target area, description of environment, design, testing and evaluation of technologies and their dissemination. The scientists in this case were required to decide which technology options were available, based on their knowledge of the area and production potential, with the farmer having a final word on innovations to be tested on her/his land.

The notion of a 'recommendation domain' was widely used in this type of analysis. This was defined in terms of differences in farm size and agro-ecology, but as Simmonds (1985) argues, agricultural diversity is certainly clear from the

perspective of these two parameters, but the social-economic and physical environments are too narrow to provide a reliable basis for targeting technology development. The recommendation domains were most often determined and used *ex post*, to identify the group or groups to which an existing technology should be disseminated.

The FSR concept became popular with donor agencies, to the extent that by the mid-1980s about 250 medium and long-term externally funded projects worldwide were implementing FSR-type activities and by the end of same period, most NARS had adopted major components of the FSR philosophy and approach (Norman 2000, Merrill Sands 1994). Many of these projects supported the establishment of separate FSR units, which often were poorly integrated into, or poorly linked to, mainstream technology development activities. Production of widely adopted new technologies was not witnessed, but the idea of looking at farmers' constraints and needs for technical change from within seemed to have been mainstreamed.

In the FSR approach formal and informal surveys used to diagnose and rank production problems. The results were then used to design, develop, adapt and evaluate appropriate technologies and also served service, adaptive and feedback functions (Merrill-Sands and McAllister, 1988, Byerlee et al. 1987, Collinson 1982, Gilbert et al. 1980). The service function involved broad-scale on-farm screening of technologies developed on-station and in on-farm locations, while the adaptive research function consisted of adaptation of existing technology to particular agro-ecological or socio-economic conditions; the feedback function involved channelling information from farming system descriptions, diagnosis or adaptive research to on-station research (Merrill Sands et al. 1989). With the adoption of this approach, various research organisations committed themselves to involving farmers in their research-and-development process, an idea that spread rapidly. As an indicator, only seven abstracts on farmer participation in research were found in ODI published journals in 1979 but this had increased to 340 by 1989 (Whyte 1991). Linkages with the extension service took different forms in different countries. In cases of weak or non-functional formal linkages to extension - as happened in Kenya - this arrangement (farmer participation) was viewed as an alternative diffusion mechanism.

Farming systems research in Kenya

In Kenya, the introduction of farming systems research was characterised by what amounted to a false start in 1978-79, due to an administrative misunderstanding which led to a negative perception by research managers

and discipline-based scientists (see Chapter 2). It was re-launched in 1983 with meetings among top managers of research and extension to discuss its role in the research and extension services (Anandajeyesekeram et al. 1986b). Subsequently, on-farm research teams were constituted in each station of the KARI system, comprising agronomists, animal scientists and socio economists, but funding shortages restricted the activities of these teams. Official launching of the research approach, now renamed 'farming systems approach to research and extension' (FSARET) took place in 1991, and involved creation of coordinating bodies at various levels ranging from National Research and Extension Liaison Committees (NRELC), through Regional Research and Extension Advisory Committees (RREAC) to District Farming Systems Teams (DFST). Owing to a critique of the level of involvement of farmers, the informal and formal surveys were replaced by Rapid Rural Appraisal (RRA) and later by Participatory Rural Appraisals (PRA) for constraints diagnosis.

Farming systems research – a critique

While farming systems on-farm research methods were expected to generate better-adapted technologies for resource poor farmers, their outcome was unsatisfactory. Diverse views around the FSR concept have been expressed by various authors ranging, for example, from Fresco (1986) who distinguished Anglo and Francophone streams of FSR, each with its own theoretical underpinnings, to Simmonds (1986) who categorised the approach into three, and Merrill Sands (1986) into eight forms. Also, as argued by Werner (1993), the scientists were inadequate in identifying and considering the production goals and criteria of poor resource farmers, since these goals and decision criteria often lay beyond the scope of researchers with little or no training in social science methods or real affinity for the lifestyles of impoverished peasants. The emphasis on quantifying the value of an innovation in purely monetary terms was also a limitation, and all these various shortcomings increased the likelihood of addressing the wrong constraint or of valuing an innovation incorrectly. In agreeing with the above view, Ashby (1990) asserted that

> *no one specialist knows as intimately as the farmer the many different needs and challenges of his/her small farm household and hence he/she is better equipped to visualise how to put a technology to work on the farm to meet those needs and problems*….(Ashby 1990)

Work by Biggs (1980a), Rhoades (1984), Richards (1985) and Sumberg and Okali (1997) independently recognised that farmers experiment on their own and that scientists might work with them to improve agrarian research and development. This perception was further supported by the work of Chambers and Ghildyal (1985) who proposed the 'farmer first and last' (FFL) model of

agricultural research and extension. These concepts were supported by the publication of an important book, *Farmer First* (Chambers, Pacey and Thrupp 1989) with the underlying proposition that a reversal was required on the part of the agricultural researchers seeking to be informed by the needs of farmers. Researchers should first learn from farmers, before attempting to instruct them.

Chambers and Jiggins (1986) portrayed farming systems research as an adapted variant of the conventional transfer-of-technology model (TOT) only differing from straight disciplinary or commodity research in regard to its better understanding of the farming system and the on-farm location of its actual research practice. The power of choice of practice mostly remained with the scientists after extracting information from farmers and analysing it to enable a prescription of solutions. While diagnosis started with the farmers, the results would be translated into terms testable by scientists, and solutions would be derived from scientists' knowledge systems, with key decisions about what to try and what to do remaining with the scientists.

Other weaknesses included its being seen as a domain and invention of social scientists, hence creating apathy among other scientists and a perceived threat to their decision making. There was massive data collection due to the farm management background of the pioneers, retention of power with outsiders through their control of diagnostic procedures, while collaboration between team members received more prominence than collaboration between researchers and farmers, with knowledge being extracted and synthesised and results transferred back again - hence the TOT mode was retained. There was also the issue of emphasis on farmers around the socio-economic mean, hence a bias against poorer farmers, failure to cultivate dialogue with these poorer farmers, and difficulties in communicating knowledge gained to other professionals.

Chambers and Jiggins (1986) also presented FSR as a modification of TOT in terms of its emphasis on 'feedback loops' and iterative cycles of referral and evaluation. The problem here was that priorities, diagnosis, evaluation, and prescription were determined by and remained under the control of the scientists. Therefore, in practice, capacity to contribute to key decisions about what problems research should investigate largely remained in the hands of the outsiders, viz. the agricultural and social scientists of the FSR team and their research station colleagues.

Biggs and Gibbon (1985) also criticised FSR in terms of its inadequate consideration of externalities and the tendency to use it as a way of promoting model approaches rather than as a research method. An undue effort was also

made to refine concepts and define a sequence of stages through which the FSR 'model' must pass. This consequently provoked a negative reaction by natural scientists. The reductionist nature of FSR and its failure to adequately articulate a broader policy framework was criticised by Davidson (1987). Collinson (1982) and Biggs (1985b) argued that the long term development of FSR would hinge on the manner of its incorporation into local research institutions, and that this had to be accompanied by means of recognising good quality field performance through suitable incentives. Rhoades and Booth (1982) argued that techniques of interaction likely to draw out the farmers' knowledge could be learned but there would be no incentive to do so 'until reward systems are altered to reflect the importance of field experience'. The lack of orientation by FSR advocates towards political variables was also criticized by Okali et al. (1994). It is therefore apparent that even though the research agenda arose from farm based joint diagnostic work, and that on farm testing of technologies was done, the analysis continued to be made within formal research circuits, and hence the approach in effect validated researchers' own perspectives and actions rather than helping them see research agenda through the eyes of farmers. Consequent upon such views and others, FSR gave way to farmer participatory research (FPR).

The advent of participatory research

The above critiques culminated in the advancing of 'farmer first' (FF) and 'farmer first and last' (FFL) perspectives, and these could be referred to as the pillars of farmer participatory research (FPR) approaches. Their main premise was not to transfer a known technology, but to empower farmers to learn, adapt and do better (Chambers, Pacey and Thrupp 1989, Chambers and Ghildyal 1985). The approaches argued for analysis of the situation to be done by farmers, assisted by outsiders (researchers, extensionists, NGOs). The emphasis was supposed to be upon experimentation in farmers' fields and conditions and not on research stations. It also maintained principles should be emphasised rather than prescribe recommendations, while messages were to be replaced by methods to provide an array of alternatives which farmers were free to test as appropriate.

Methodological tools to encourage dialogue between farmers and researchers were introduced. These were mainly PRA tools, involving diagramming, transects, mapping, crop calendars and other attempts to articulate production and organisational constraints, and to trace out structural impediments affecting the farmer's situation. Appropriate on-farm trials were then jointly designed to test options that would fit the farmers' identified constraints. Various participatory approaches (Table 1) - as diverse as the agencies

introducing them - were then introduced in an attempt to circumvent the shortcomings of farming systems research, especially those applications of FRS that tended to exclude the farmer from the research process.

Table 1: Participatory research approaches, the agencies involved, and the period they were implemented in KARI stations 1991-2006

Agency	Approach	Year	Stations	Commodity /factor
DFID	*Farmer Participatory Research FPR)*	*1991-98*	*Embu, Kisii, Kitale, NARL*	*Crops/crop protection*
DGIS/KIT	*Farmer Participatory Research (FPR)*	*1991-98*	*Mtwapa,Katmani, Kak'mga, Perkera*	*Crops,/Dairy cattle*
DGIS/KIT	*Participatory Learning and Action Research(PLAR)*	*1992-95*	*Kakamega*	*Soil fertility (maize)*
Rockefeller Foundation	*Participatory Technology Development, Farmer Field School*	*1996-2001*	*Mtwapa,Kitale,Kisii, Embu*	*Soil fertility(maize)*
CIMMYT	*Farmer Participatory Research, Participatory Variety Selection, Participatory plant breeding*	*1998-present*	*Mtwapa,Katumani,Kitale, Kakamega, Embu*	*Maize Variety, Agronomy*
CIP	*Participatory Technology Development.*	*1997-2001*	*Regional/national*	*Root crops*
FAO/IFAD	*Farmer Field School*	*1996-2001*	*Ministry /research*	*General*
ICRISAT	*Farmer Participatory Research*	*1998-2000*	*Katumani, Embu*	*Sorghum and millet*
ICRAF	*Participatory Technology Devpt*	*1996-2005*	*Embu,Kakamega*	*Agroforestry*

Despite the introduction and use of the participatory research approaches, certain indications are that a shift to these approaches seems incomplete, as manifested by low utilisation and out-scaling of jointly tested technologies, confirmed in low adoption rates and negative findings from impact studies following various participatory research projects conducted in Kenya. This limited success for participatory approaches in the Kenyan case brings us to the research issue to be addressed in this thesis.

2. The research issue

As stated earlier, agricultural production and productivity challenges in Africa, and Kenya in particular, are complicated by diverse factors, with a critical one being the heterogeneity of the environment, as well as the inadequacy of various support institutions. In such a situation, it is imperative to develop adapted crop and management practices to cope with prevailing and

anticipated ecosystem challenges. Integration of the different farm enterprises is necessary with a view to harnessing synergies, with an example of such an integration being livestock-crop integration, or crop-crop and crop-tree integration, as in agro-forestry systems, and other similar and more complex combinations. The research and extension system for producing and disseminating such technologies must be adapted to the needs of the farming systems within the context of tropical rain-fed agro-ecosystems insufficiently supported by access to input, output and credit markets. The current research system has endeavoured to address the prevailing circumstances with various levels of success as depicted by the many improved production technologies and options and impressive rates of return from the research centres (Maredia, 2000, Hassan et al. 1998a, Karanja 1990). But despite some signs of success disappointing results, particularly at the stage of technology uptake and scaling out, have been encountered which raises a number of issues warranting further detailed investigation.

These issues include questions about the level of familiarity of researchers and other agricultural professionals with the true range of agricultural production systems and localised environments in Kenya. Added onto this is whether and how farmers' agricultural production practices are accommodated into the technology testing and development process. These are issues to do with the state of appropriateness of the technologies to the social contexts of various farming systems. Diagnostic events implemented at the beginning of many research projects partially provide some insights into what occurs within a certain project area, but a lot of such activity gets finally directed by the agenda of the specific project. Furthermore as argued by Scoones and Thompson (1994), what people do is not consciously expressed as knowledge, but is bound up with their actions and expressed in private terms which many researchers might find difficult to decipher. This agrees with Cati (2001) that questions asked by field workers in trying to understand the nature of talk and knowledge may elicit different kinds of information and relationships from those expected. Furthermore, as Scott (1990) argues, interactions between the less powerful (farmers) and the powerful (researchers) is riddled with ''hidden transcripts'' which almost always drive a social discourse in which subservient individuals reveal only those parts of their full transcript to an extent they judge safe and appropriate to reveal.

As illustrated by a few cases below, positive impacts have been encountered, but there are many cases in which it is clear that further research is required to make available technologies appropriate to users.

Impact studies conducted in 1999 and reported by Mukisira (2000) showed that the use of improved maize varieties increased from 2% (1960) to 73% (1998) of total maize area, while use of integrated soil fertility technologies (ISFTs) raised maize yields by 71%. The same report indicated that 50% of Kenya's wheat demand was met locally while dairy cattle zero grazing systems accounted for 90% of commercially supplied milk and production of the new Tigoni potato variety Tigoni had a positive impact on farmers' income. Reporting on KARIs achievements from 1996 to 2002, the director of KARI mentioned release of 167 improved varieties of food crops and 10 vaccines and kits (KARI, 2005). Collaborative work with various CG centres had also led to many new technologies, as well as contributions to policy formulation (SHD, KARI/ILRI).

However, in spite of the above institute success stories (based on the institutes indicators), low adoption of improved technologies was reported in various reports for example in a beneficiary assessment study of selected KARI technologies in 2003 (Muchena, 2003). Utilisation of jointly tested technologies such as improved maize varieties has been shown to be lower than expected, with farmers retaining a preference for their local materials and management practices, as shown by Groote et al. (2005), and Wekesa et al. (2003) in Western and Coastal Kenya respectively. In these studies, farmers preferred local and recycled seeds over the improved commercial maize varieties in both areas, despite the 29% yield superiority of improved maize yields and a variety-specific 6-56% increase in gross margins in Coastal Kenya. Both studies also found that management practices were not adopted due to their cost implications. In another study by Mose et al. (2000) on preparation and use of compost manure, 62% of farmers adopted handling and preparation methods of compost but only 35% applied it with several modifications to suit their circumstances. Modification of recommended management practices was also reported by Mose et al. (2000) in a study of five clusters in South West Kenya, where 24% of farmers reduced the recommended inorganic fertilizer rate, 28% used a little *Tethonia diversifolia*, (a green manure), 32% used local concoctions for pest control and 73% did not turn compost during preparation and only 38% of farmers in five clusters used the packages as recommended . This agrees with van der Ploeg (1994) who argues that particular elements are reconstituted and combined with already existing elements, so that eventual usage differs considerably from the original technical design. In effect, technologies are never applied in a vacuum, and their introduction to farming communities requires accommodation to various local bodies of practice and knowledge (Mbithi 1973, Hebink 2001). In a study on green manures legume Odendo et al. (2000) reported high labour demand, lack of seeds and incompatibility of rotations with existing farming systems as challenges to farmers, and also that recommended technology was applicable only at a small-scale. Similarly, a

study by Kidula et al. (2000) concluded that trials implementation labour overwhelmed farmers, leading to unsatisfactory results. A survey conducted by Hassan et al. (1998b) showed that Kenyan farmers applied less than economically optimal rates of inorganic fertilizers on hybrid maize, thus denying the country a possible extra one million tonnes of maize.

An analysis of various participatory trials by Kungu and Mwania (2000) concluded that farmer research committees did not solve trial implementation problems as expected, and inadequate farmer participation and feedback were recorded. This indicated that awareness of the need to listen to farmers does not necessarily lead to change of approach and different technology paths are pursued despite findings from consultation. A joint ICRAF/ KEFRI/KARI study in Western Kenya (Franzel 2001) reported no recognition was given to farmer innovations and feedback despite their acknowledged importance in determining future research direction and guiding policy decisions.

The above studies and others indicate that despite efforts made to tailor and adapt technologies to farmers' needs and conditions through participatory research, adoption is still restricted to a few experimenting farmers, in line with an argument of Callon (1992) and Latour (1994) that external knowledge is 'translated' but not readily internalised, as researchers would expect. As further suggested by Mango (2002), both incoming knowledge as well as certain existing bodies of knowledge become transformed, resulting in a broadening of knowledge, but perhaps with unpredictable and unexpected results. According to van der Ploeg (1994), when farmers modify and redesign the technologies this, often amounts to a deconstruction of a technical design, whereby particular elements are reconstituted and combined with existing elements, thus considerably changing the original technical design. Conventional research tends to overlook this process and usually does not consider the integration of new and local knowledge as 'adoption'. Non-experimenting farmers also encounter this information, but adoption by them is rare, despite the notion of farmer-to-farmer diffusion. Diffusion pathways and adoption strategies are thus considerable more tangled, complex and unpredictable at the level of small farmer reality than envisaged by some – a finding consistent with Long and van der Ploeg (1989), who argue that interventions are part of a chain or flow of events located within the framework of different interest groups operative in civil society. As Mango (2002) further states, redesigning is a manifestation of farmer responses to dominant technological regimes, and reflects social heterogeneity, since farmers do not belong to a single social group. Even within groups farming management strategies and styles may differ enormously.

A clearer understanding of the encounter between researchers and farmers, and their different knowledge sets and experiences, and of the influences of these encounters on technology generation, would be valuable, for as reported by Rhoades (1984) and Richards (1985) putting together new and effective agro-technical knowledge depends on complex processes involving social, situational, cultural and institutional factors. This results in many types of knowledge in different localities, and styles of putting such knowledge into effect. This is why a key requirement for any research on agro-technical research is to start with careful description of technical processes in context.

Some technology researchers have used the word 'technography' (by analogy with ethnography) to designate this empirically-oriented analytical task (cf. Richards 2000, Woolgar 1988). Here it is deemed important to describe and analyse 'technographically' the processes taking place at the points where researchers and farmers interact over technological development.

The technographic approach is adopted in this thesis is to study actual research practices in Kenyan Agricultural Research Institute from which technical innovations result, and especially those research practices involving farmer consultation and other forms of client-oriented participation. These technical innovations embrace not only tools, planting materials, seeds and other associated processes but also researchers, farmers and other agents and users of technologies, and how they are bound together in a variety of social and institutional relationships. An understanding of the heterogeneous relationships that determine how the various actors go about their activities is important for a clear technographic view of how the research process takes place. To elaborate on these practices, in the research institute and in farmers' fields, various selected concepts are used as described below.

3. Definition of concepts

The central objective of the present study is to provide an objective, technographic account of agro-technological research practices in a farmer participatory environment, with a view to improving the functionality of the approach. The concepts used to orient the study include the notion of continuity and discontinuity, heterogeneous networks in participatory research, and the idea of 'counter tendency', as a basis for an attempt to understand the agro-technical research process in KARI in relation to farmers own organised activities.

Continuities and discontinuities in Kenya's research and extension system

The history of research in Kenya is reviewed to show how research was organised during its early days, and how it has evolved to the present period, using the organising notion of continuity and discontinuity to view changes over time. Continuity refers to the state of uninterrupted flow or coherence, or the property of a continuous and connected period of time (Oxford English Dictionary). Synonyms are persistence, enduringness, durability, lastingness, strength or permanence by virtue of the power to resist stress or force. Discontinuity is the state of interruption or incoherence and hence the opposite of continuity. In this research, the concepts of continuity and discontinuity were used with reference to an uninterrupted or interrupted flow or a connected or disconnected period. Periods considered here mainly have to do with the historical perspective of the agricultural sector with a focus on the research system.

As has happened in many other former African colonies, policies and development plans, as well as a majority of elements in the administrative system, are modelled along the lines of those prevailing in the state from which the colonial power emanated, and Kenya is no exception. Certain aspects, however, have been obliterated as African countries have trudged different development pathways, turning to a variety of aid partners for alternative ideas and concepts. As Leys (1975) illustrates, there were interests to be protected in Kenya in the transition from a focus on the 'white highlands' to the former reserves, as reflected in the adoption of African Socialism, and its application to planning in the early seventies. The key policies pursued were individualisation of land tenure and differential credit provision, supplemented by efforts to integrate peasant production into the established capitalist economic framework. This no doubt helps explain certain continuities and/or discontinuities in the thinking, modelling and operations of the research system. What was expected to change by a new administration may or may not have changed, declarations of government policy notwithstanding, due to the retention or emergence of other structures, perhaps meant to satisfy political ends, as well as the demands of various competing external and internal actors. The notion of continuity and discontinuity therefore fits well in trying to analyze various operational practices that may or may not have remained uninterrupted, and the reasons behind these at times surprising shifts and retentions. Practices in current research are contextualised through comparison of what happened in the past and what happens today, and the influence these continuities and discontinuities have an influence on communication between farmers and researchers.

Heterogeneous networks

Heterogeneous network is a concept borrowed from Actor-Network Theory (ANT) as in Latour (1987), Law (1992) and Callon (1999). The concept refers to inseparable social and technical entities that act in combination, thus making the social context within which technology operates inherently heterogeneous. This leads to recognition of entities that are socio-technical networks made up of heterogeneous materials (i.e. involving both human and non human actors) bending space around themselves to make others dependent. A heterogeneous network is considered to comprise relations among people and social groups as well as among non social elements ('actants') such as machines, tools, animals, texts, money, architecture, artefacts, etc. (Law 1992, Latour 1994, Mackenzie et al. 1999). According to the theory, the network cannot be reduced to either the actor or the network, since the actor has activities that span diverse elements, and the network is capable of redefining and changing the elements of which it comprises. This includes competencies that are negotiated in a process of trial and error and have an independent reality outside the settings that turn them into actors doing particular things. The actors form alliances, enrol other actors, use artefacts to strengthen such alliances and secure interests, hence creating networks via three stages. These consist of problematisation, convincing others of the indispensability of certain elements, and finally enrolling the necessary elements and sealing them in a 'black box'.

The black box of the actor-network contains a sealed network of people and things, and the more a box appears to be closed, the more the networks it contains are assumed to be reliable and stable in themselves (Latour, 1997,1987).

The social groups and materials included are determinants of the costs of reopening the box and hence its stability and once a box is sealed, attention is diverted elsewhere. The intended product of these networks can be nature in the form of scientific facts, technology or society, but there can also be hybrids of the three domains simultaneously. In this sense the networks are material, like nature, but also comprise real but immaterial 'social facts' (e.g. institutional norms and procedural rules). It is in this sense that actor-networks are heterogeneous and as Latour (1998) argues, the idea behind the actor network is to designate two faces of the same phenomenon, like wave and particles.

The notion of a heterogeneous network can be applied to a research institute like KARI, where various actors and 'actants' are constantly striving to 'translate' and 'enrol' each other into their networks and projects. KARI research managers have to convince the outside world that the research system has appropriate strategies to confront poverty and food insecurity and hence

financial support should be provided. The outside world involves various stakeholders who include the government, funders and collaborators. The convincing is done through project documents and presentations by the managers at various fora following the formats required by the various stakeholders. The same is repeated by research scientists who strive to convince stakeholder committees in the research centres that their research is addressing pertinent issues through appropriate strategies. By so doing, these actors (working at different levels) problematise issues in such a way that they convince and enrol funders and gate-keeping committee members to support specific research projects. The development and testing of research products involves interaction of social, technical and physical entities. In this case the influence of each agent and actant has to be factored into the research process. While technical and physical entities may be well taken care of by KARI scientists, it is a hypothesis of this research that a comprehensive understanding of the farming actors and groups may be lacking, and hence result in miscommunication and hence failure to form a stable and effective actor-network focused on farmers' real problems. The risk is that a rhetorical 'black boxing' then takes place, in which funding continues to flow, but traction between the network and real problems is lost.

Actor-network critique

The actor-network theory has been criticised for the poor analysis it offers in respect of the actor, because it is vague about the nature of actors. Seemingly, the size of actor group its psychological make-up and background motivations are predetermined. Since everything is action, the ANT actor may, alternately and indiscriminately be a power, enrolling and dominating, or by contrast, an agent lacking even the initiative to be willingly enrolled. This vagueness about the identity and capacity of actors (i.e. their agency) has led to the frequently repeated accusation of relativism in ANT. Despite these concerns, I continue to find ANT a useful way to think about the emergence of heterogeneous networks of scientists, farmers, crops, soils (and other actants) in the Kenyan setting. The vagueness and risks of relativism associated with ANT can be addressed, I shall endeavour to show, but maintaining empirical focus.

Participation and participatory research

Participation is a widely used notion but it obeys no single definition, as illustrated by many variants in the literature (Biggs 1989, Uphoff 1985, Oakley 1991, Pretty 1994, Cornwall and Jewkes, 1995). It can include situations involving joint action, or the sharing of something in common, or active involvement in making decisions that affect all members of a community. According to Oakley (1991) many projects promote participation but are

initially unaware of the full implications of the participatory process. The idea gains ground (wrongly) that participation is just another input to be programmed and managed, and this prevents assessment of the level of participation. It also means projects fail to select the requisite methodologies to promote participation. The concept has been applied (if badly) in many fields, including rural development, health provision, industry management, and agriculture, among others.

In the development field, participation is utilised both as means and end. Viewed as a ''means'', participation helps in the attainment of certain outcomes or results, such as, for example, a new construction or adoption of a new agricultural practice. Exogenous development has traditionally given little recognition to skills and local knowledge. It was commonly assumed that the local community had little to contribute to increasing the social, cultural, economic or political appropriateness of development projects. Participatory research as a means or tool addresses and seeks to change this attitude, by seeking local participation to fully incorporate local context into development schemes.

Cornwall and Jewkes (1995) define participatory research as research conducted with a focus on locally defined priorities and reflecting local perspectives, i.e. a ''bottom up'' research approach. According to Okali et al. (1994), farmer participatory research has a lot in common with farming systems research, but there are some conceptual differences. Jiggins (1992) suggests that farming systems research is a bridge between conventional research (formal science) and an emerging body of experience drawing upon farmer participatory development. It is worthwhile to note that while participation has been known to enhance effectiveness, it involves more than just taking part. It involves active involvement and choice, and the possibilities of realising such choices (Cornwall et al. 1994). In the context of this research, there is concern to understand who generates, analyses, represents and acts on the information that is sought. These are important questions to ask in participatory research. The ''who'' question focuses attention on the issue of power, its alignment and control within the research process, which marks a major distinction when compared with conventional research.

Cohen and Uphoff (1980) suggested four key stages in the participatory process: decision-making, implementing, benefit sharing and evaluation. In each stage there should be evidence of people's involvement. Oakley (1991) argues that there are three broad interpretations of participation: voluntary contribution, organisation by local people and empowerment in skills, abilities and independent decisions. He argues that projects are unlikely to attain all these

requirements, but the degree of participation desired must be made clear at the outset and in a way acceptable to all parties.

Biggs (1989) made an overview of four modes of farmer participation in agricultural research: contractual (involving an arrangement between farmers and researchers on use of farmer's land or animals), consultative (when information is sought from the farmers), collaborative (involving equal roles for researchers and farmers), and collegial (with farmers taking the initiative to organise their own activities). Farrington et al. (1993) expand on Biggs' typology by referring to depth and scope of interaction, and by highlighting organisational issues, while arguing that deeper levels of participation tend to rely more on group than individual approaches. Pretty et al. (1995) recognise seven forms of participation: passive participation, participation in information giving, participation by consultation, participation for material incentives, functional participation, interactive participation, and self-mobilisation. Of the seven, the first can be placed lowest on a 'ladder of participation' and the last on the highest level. Wals and Heymann (2004) define four types of participation, depending on the level at which participants are involved in the process (whether active or passive) and the level at which there is space for their ideas (i.e. predetermined or self determined). A combination of these levels leads to four main forms of change in the direction of sustainability. In the context of the present research Biggs classification is used to analyse participation in the research projects under study.

It is worth noting, however, that while this is a convenient way to distinguish between the various types, participation is a contested process that can have contradictory outcomes. The extent and types of participation will change and develop overtime in response to individual and group needs and desires. This has implications for the breadth of participation and achievement of its objectives and goals.

Participation and knowledge generation

According to Foucault (1980), belief systems gain momentum as more people come to accept a particular view associated with these belief systems as common knowledge. Such belief systems define the figures of authority, such as doctors and priests. Ideas crystallise as to what is right or wrong, what is normal or deviant, and what views, thoughts or actions are thinkable, within specific belief systems. Following Douglas (1986) belief systems are, in turn, sustained by institutional forms, and modes of social organisation. A lot of debate has surrounded local and formal scientific knowledge, with initial reactions being that the two are separate systems of thought (Richards 1978).

Images of separateness create an impression of local and non-local knowledge systems, and hence undermine the rationale of participatory research. Swift (1979) argues that local knowledge differs from scientific knowledge in that it is constrained by orality and direct experience and held in the heads of practitioners.

Perceptions have also been changing as shown by the tendency to illustrate similarities rather than differences. Hence Chambers (1992), for example, argues that possessors of both local and formal knowledge understand growth stages of plants and benefits of irrigation. Scoones and Thompson (1994) hold that local knowledge is manifold, discontinuous and dispersed, and not a singular cohesive and systematised (but different) system. They go on to aver that local knowledge is constructed through rural peoples' practices as situated agents, since they are actively engaged in the generation, acquisition and classification of knowledge, and as situated, since this takes place in cultural, economic agro-ecological and socio political contexts that are products of local and non-local processes.

The greatest advantage that researchers have over farmers is their wider access to outside sources of knowledge, and the different manner in which they examine relationships. Yet it has not yet been demonstrated that this is always better in answering the kind of site-specific questions that the farmers often pose. Through these debates, it becomes clear that participatory research is as much about creating and managing a specific interface between locally generated and outsider knowledge as it is about indigenous knowledge per se.

A basic premise underlying the move toward farmer participatory research has been that local knowledge has been ignored and at times actively denigrated; as such, it has been unable to withstand the onslaught of outsider knowledge (Wolley 2002). A challenge remains to create equitable sharing of information, but the challenge is the social distance between peasant farmers and researchers. This makes it hard or impossible for farmers to disagree with experts in discursive events such as workshops. It is also generally known that research institutions regard their knowledge, often derived from positivist methodologies, as inherently superior (Mohan and Stokkes, 2000). Yet it is also recognised that all information and knowledge is liable to transformation during the process of communication, and hence local people have capacity to absorb and rework external knowledge and information in light of their experiences and understanding.
Hence Arce and Long (2000) state that:

> *….production and transformation of knowledge resides in the processes by which social actors interact, negotiate and accommodate to each others life*

> *worlds, leading to the reinforcement or transformation of existing types of knowledge or to the emergence of new forms.*

With participatory approaches emphasis at the technical level is placed on adaptation rather than adoption or the use of outside knowledge to create completely new production systems. On the whole, it is clear that while empowerment is envisaged as an output of participatory research, it also emerges that researchers from the public research system are associated with government, and not only represent the powerful interests of their employers but are themselves powerful (consider for example their superior power to attend and remove themselves from meetings, through access to official transportation). This is to support the argument of Mohan and Stokkes (2000) that there is a need to examine the political use of 'the local' by various actors (local knowledge could, for example, be seen as opinions underpinned by non-comparative findings, among those who have little practical opportunity to make such comparisons). Thus there is need for a dynamic analysis of the way in which both farmers and state representatives struggle, negotiate and compromise during the process of change in which interventions are modified and this is possible through a technography.

Participation critique

Much literature is available on the subject of participation, advocating it as the most effective rural development approach. But some shortcomings in the concept of participation have been raised by various authors. According to Hickey and Mohan (2005) and Mohan and Stokkes (2000) a key argument against participatory development is the obsession with the local as opposed to wider structures of injustice and oppression, with insufficient understanding of how empowerment may occur. This critique is also echoed by Mosse (2001), who argues that local knowledge is much sought after by those planning development projects, but that it is shaped and selected by perceptions of what the agency in question is able realistically to deliver. In the context of this research, the research organisation is able to offer only what is within its technical mandate, and so-called 'non technical issues' are addressed by other organisations. Added on to this is the fact that the research institute has to factor the temporal nature of donor funded projects into its operations, and this curtails many necessary processes. This confirms the argument of Mosse (2001) that ideas of participation are oriented towards concerns external to project locations. Participation is then used as a means rather than an end to achieve project goals; the heroic claims made for participation as a motor of true inward development need to be treated sceptically (Cleaver 2001).

People are capable of empowering themselves without necessarily being tied to donor preferred institutional arrangements that may not correspond with those ''participants''. As long as the ''project'' matters to participants the structure responsible for implementing it will evolve from within. But to comprehend what may be happening (or not happening) it is important to understand social agency, and the links between agents and wider social and institutional structures.

Often, developers make vague or simplistic assumptions on why people participate or fail to participate, which they attribute to catch-all notions such as 'irrationality' or 'irresponsibility' of participants. These conceptualisations fail to differentiate between inclusion and subordination in participatory processes. Voluntary participation in a project is more effective than any imposed from outside by agencies out to achieve certain predetermined objectives.

In many participatory practices it is assumed that use of participatory rural appraisals, or variants using a large set of diagnostic tools, is adequate to make a project participatory. Francis (2000) avers that PRA is like a rite of communion whose performance exorcises the ills of conventional development practice. This has led to emergence of PRA experts or PRA projects that do not go past the prioritisation of constraints or SWOT analysis. The new emphasis on the social, according to Francis, gives little attention to the underlying structural determinants of well being. In the context of this thesis, problem diagnosis is a critical stage in the participatory process but it is recognised that such analysis may carry little significance if subsequent activities are unrelated to the issues raised. Problem diagnosis only raises expectations, and frustration leading to loss of faith follows where problems remain unaddressed, because, for example, they lie outside the mandate or competence of the agency concerned. It is important to be aware of these dangers before the pot is stirred.

Intervention processes are embedded in, and generate, social processes that implicate aspects of power, authority and legitimation. They are known to reflect and exacerbate cultural differences and conflicts between social groups, and perhaps less frequently than assumed they lead to establishment of common perceptions and shared values It then becomes unreal and foolhardy to imagine that facilitators can easily and gently nudge or induce people and organisations towards more 'participatory' and equitable modes of integration and co-ordination. This is the central paradox of neo-populist discourses and participatory methods aimed at empowering local people. As Cooke and Kothari (2001) argue, proponents of participatory development have been naïve about the complexities of power and power relations. These complexities affect not only relations between donors and beneficiaries, or participants and

facilitators, but also basic notions of what constitutes knowledge and social norms. There are multiple and diverse ways in which power is expressed, and furthermore these expressions are embedded in social and cultural practices.

The rhetoric of 'listening to the people', understanding local knowledge, strengthening local organisational capacity and promoting 'alternative development strategies', carries with it the connotation of power being 'injected' from outside. This purpose of such attempted injections is to shift the balance of forces towards forms of local self-determination. This implies the idea of empowering people through strategic intervention by 'enlightened experts' who make use of 'people's science' and 'local intermediate organisations' to promote development 'from below'.

These criticism have some force. While solutions to local peoples' problems have to be addressed, the issue of substituting 'learning' for 'blueprint' approaches, or 'old' by 'new' style professionalism geared to promoting participatory management, research and evaluation methods has to be carefully assessed. Bebbington and Virrareal (1993), for instance, argue that exploitation of the peasantry by the state and a new agrarian bourgeoisie is integrated with discussion of participation and empowerment via farmer participatory research. This exploitation is legitimated under the guise of the powerful outsider helping the powerless insider. Such formulations, however, do not escape the managerialist and interventionist undertones inherent in the very idea of development. There is a tendency to invoke the image of more knowledgeable and powerful outsiders helping the powerless and less discerning local people.

Many field practitioners facing the everyday problems of project implementation show an acute awareness of this core paradox associated with participatory strategies. However, no matter how firm the commitment to good intentions, the notion of 'powerful outsiders' assisting 'powerless insiders' is constantly invoked. According to Amanor (1993) the question of empowerment by local people cannot be adequately addressed within the confines of farmer participatory research. Theoretically, Farmer Participatory Research (FPR) is supposed to start with an analysis by local people, and emphasis is laid on their capacity to solve problems and seize opportunities. This approach is potentially empowering and particularly so when accompanied by research efforts supportive of the capacity of people to empower themselves (Villareal 1992). The limitations of the approach to empowerment, however, need to be considered, since in many cases it is focused too narrowly on agro-technical

intervention. This focus may block out other seemingly unrelated (but in practice vital) issues, such as an inegalitarian system of land tenure.

It is in the light of the above mentioned criticisms that research practices and approaches involving farmer participation in the KARI system were analysed. These practices include among others, farming systems research and extension, Participatory Rural Appraisal (PRA), Farmer Participatory Research (FPR), Participatory Technology Development (PTD) and Participatory Learning and Action Research (PLAR). These were analyzed from the standpoint that today's research culture is shaped by the past in terms of what has changed and what remains constant. Research culture is also shaped by applicable mandates, goals or targets bearing down upon the various heterogeneous networks involved in research.

Counter tendency and counter points

Counter tendency is a concept offering a useful vantage point for understanding the diversity of difference in local people's images and discourses that give meaning to their actions. It is a balancing act between introduced bureaucratic procedures and local practices, and is oriented towards understanding and acting upon the processes through which multiple modernities are established. It may be understood from the point of view of social change and development as multi dimensional and contested realities (Arce and Long, 2000). Central to the notion of counter tendency is the attempt to track and uncover how technologies, information, material resources and other cultural repertoires are received and translated by locally situated actors. The basic idea is that any such reception involves local re-assembly and re-positioning of external elements in relation to so called micro influences and frameworks.

The significance of the concept is in the way that it promotes alternative agendas for change, and can under certain circumstances challenge the assumptions made by central authorities. In this thesis, counter tendency is used to probe the many processes and entities that deviate from the expected flow of things and thereby lead to different and unexpected outcomes. The notion is comparable to the counter-development that Galjart (1981) argues is strategic in countering dominant development trends and thinking, and which helps avoid the danger of viewing development simply as a geographical and administrative process of incorporation.

Galjart's view also questions the image of the state as the only legitimate body for carrying out the many tasks relating to law and order, maintenance,

economic planning and delivery of public services. As often happens, any protest and dissent is met by a flexing of state muscle to avoid undermining state practice. Such political moves often result in generation of de-centralisatised political decision-making, thus creating room to further develop alternative or opposing policies. Support for such counter-tendencies by various actors, rather than trying to manage uncertainties, can be advocated as a means to create diversity of choice of development strategy. This agrees with the argument of Rip and Kemp (1998) about the challenge posed to existing regimes - whether technological or developmental - by niches harbouring alternatives.

The notion of counter-tendency alerts the analyst to representations, practices, discourses, performances, organisational forms, institutions and forums questioning modes of authority. It is by gaining an understanding of how different actors go about their various tasks and livelihood concerns that we can avoid the homogeneous picture often painted of a unified rural 'community'. Applied to research projects, counter tendency limits the power associated with the agrarian practitioners' role.

In taking this stance, it is important to question neo-localism, which as Mohan and Stokkes (2000) point out, is similar to assuming that the centre has nothing to offer. This stance is populist, in treating all external knowledge as tainted, and is inimicable to genuine dialogue and learning. In the context of this study on KARI, the aim is to advocate for a mutual exchange between farmers (and their localized projects) and researchers, who have to step out of their confines of often prescriptive research projects. This stance creates room for many useful experiences from both sides. It calls first and foremost, however, for recognition of a variety of farmer projects; the nurturing of localised modernities, as argued by Arce and Long (2000), has to be done by individuals who are cognisant of their implications and how to support them.

A final issue taken into consideration is the subjugation possible through politicisation of the local by various actors, as argued by Mohan and Stokkes (2000). At issue is the tendency for participation to become a discourse of Western donors backed by resource flows; aid-dependent nations may not believe in participation, but they ignore it at their peril, since they will then lose development capital.

4. Research questions

This study seeks to find out how farmers and their groups function within a research process in which the National Agricultural Research system of Kenya is the major player on the government side. The study covers both 'purpose made' participatory groups, farmer-organised groups, and those with a latent potential for participation in agricultural research. The central questions that thesis sets out to answer were:

i) *How has the agricultural research organisation changed over time and what is the influence on the current relationship between Kenyan researchers and farmers?*
This question aims to assess the extent to which KARI has made the shift to a different research organisation with more emphasis on farmers' knowledge and farmer participation. It aims to elaborate what influenced the shift, how it was elaborated and internalised, through various strategies and mechanisms, such as joint diagnosis using PRAs, joint planning through CRACs and RREACs, and joint evaluations.

ii) How does information exchange take place between and among researchers and farmer research groups, farmer organised groups and function groups?
The purpose of this question is to direct attention to the status of actor practices, comprising of social relations of production, scientist-farmer relations, relations between and among scientists, and emergent potential networks among groups.

A number of sub-questions have been formulated to direct the information collection and analysis. These include:

i. What was the nature of interaction between researchers and farmers before and after the introduction of participatory research?
ii. What role do the research managers, research scientists, collaborators and farmers play in the research process?
iii. How are farmers views incorporated into the different research stages?
iv. What information exchange mechanisms characterise farmer research groups, as compared to farmer-organised groups and other function groups?
v. What lessons do alternative (farmer-organised, and latent) groups provide for participatory research practice?

Research approach and methodological choices

The Kenya Agricultural Research Institute (KARI) was chosen as the main focus for this study. Its research network is distributed all over Kenya. The research was conducted mainly through direct observation, individual and group

interviews, and examination of archival records. The data was collected from collaborators and other stakeholders, with particular attention paid to the interaction of smallholder Kenyan farmers and KARI researchers within the study area. As Ravetz (1973) has argued, the nature of scientific activity is thoroughly misrepresented by the form of presentation used in the reporting of science to outsiders. It is for this reason that Latour (1987) argues that it is necessary to make *in situ* observations of scientific practice, to retrieve a sense of the craft (i.e. artefactual) nature of science as practice. In this research, direct observation was undertaken in research centres, as various activities were taking place, as well as in the field, where researchers interacted with farmers. A purposive sampling procedure was adopted in order to obtain information from the specific areas and individuals of interest to the study. It is also worth adding that the author is a KARI researcher, and the thesis also makes use of reflections upon personal experiences over a number of years.

Sampling and sample size

Technography is a name adopted by some researchers (e.g. Richards 2002) to cover an ethnographic (i.e. observational) approach to the understanding of technological systems (both design and operational processes). Technographic (observational) methods were used to analyze research practices in the publicly funded Kenya agricultural research institution, one of Sub-Saharan Africa's larger NARS. The sampling population comprised the research centres, from which two regional research centres were purposively selected. Within this selection, two KARI programmes (Food Crops and Soil and Water Management) were considered from which two projects (maize and soil fertility) were further selected for detailed study.

The idea was to provide in-depth information on how diagnosis, research agenda setting and implementation take place using participation as the central concept. As argued in Latour (1987), science and technology should be studied in action (i.e. in the making) because with time, scientific discoveries are 'black boxed' (i.e. they become accepted as artefacts with a standardised role), and this makes it difficult to understand their origins or the basis upon which their functionality came to be discovered.

Through use of technographic methods, the interaction of Farmer Research Groups (FRGs) with scientists in various joint projects was studied. This was contrasted with interaction of farmers in Farmer-Organised Groups (FOGs) with no extension or research support, using the notion of 'counter-tendency' to attain insights into participatory activity when there was no direct researcher input.

A big problem with participatory methods of rural development more generally is a tendency for rural elites to 'milk' participatory initiatives for resources and 'social capital' unconnected with the basic aims of the intervention (Kiptot 2007). Whereas most of the present thesis focuses (technographically) on the deliberate efforts by KARI to implement a participatory approach to agro-technical research and development activities attention was also paid to options for revitalisation of the approach, free of 'project effects' (cf. Richards 2007).

During the field work for this study, a pilot action research project on sweet potato vine rapid multiplication was also conducted with selected school 4K[2] farming clubs, with a view to exploring and getting insights about options for operationalisation of participatory research when working with groups with a latent function.

The districts within which projects were implemented were identified, and localities together with groups or individual farmers working with the researchers, then selected. Other activities taking place within the locality of these project sites were also observed.
Out of a total population of 22 national and regional research centres (the sample population,) nine adaptive (also known as regional) research centres (Table 2) were scrutinised, with two (Embu and Kakamega) then being selected for in depth study. The reasons for choosing these two were that they have a long experience with participatory research, starting from its advent in Kenyan agricultural research. The two are located in different geographical locations of the country and have different socio-cultural environments. While the number of mandate districts and populations are different, the agricultural land area covered by the two stations is almost the same.

Table 2: The attributes of the nine KARI regional research centres

Centre	No. of districts	Ag.Area (000 ha)	Farm house holds	Popn. 1999 (m)
Mtwapa	6	3.04	324,794	2.15
Embu	***8***	***1.002***	***616,243***	***2.98***
Kakamega	***12***	***1.076***	***962,082***	***4.88***
Kisii	9	0.983	588,915	3.02
Perkerra	6	3.658	231,304	1.15
Kitale*	4	1.339	387,785	2.09
Katumani*	5	3.884	492,022	2.74
Njoro*	4	0.901	483118	2.366
Marsabit*	9	24.731	283563	1.779

*dual mandate centres *(Source: KARI medium term plan 2002-2007)*

[2] School based agricultural clubs whose acronym stand for *Kuungana* (Coming together),*Kusaidia* (to help), *Kujenga* (build) Kenya)

Research projects being implemented at the two centres were then considered, from which various participatory research projects were purposively selected (Table 3). Out of 10 (38% of total centre projects and 11 (25% of participatory projects in Embu and Kakamega respectively, seven projects were chosen from which four were finally selected.

Table 3: Selected centres and projects

Station	Total project	Participatory Projects (%)	Initial sample	Final Sample	Total Districts	Districts Pax proj	Districts sample
Embu	26	10 (38)	**7**	4	8	4	4
Kakamega	44	11 (25)	**7**	4	12	4	2
	70	**21(30)**	**14**	**8**	**20**	**8**	**6**

(Source: KARI Embu and Kakamega 2003 reports)

Data sources and collection

Past and present research practices in Kenya were studied, with emphasis on the emergence of agricultural research, current organisation of research and the interaction between researchers, farmers and farmer groups. A review of selected agricultural research was conducted from historical records for the period 1900 to 2000 (Table 4). These records were obtained from various sources, including the National Archives, libraries and other sources. Interviews were also conducted with certain staff. At the institute headquarters and in the centres, interviews were held with the researchers and research managers, besides other staff. In the farms interviews were held with the farmers and non farmers alike.

Table 4: Data sources, sampling and study units

Data type/ source	Sampling population	Sample size	Study Unit
Historical data	*All colonial records (1900-2000)*	*All Research records*	*Small holder focus*
Research (1954-2004)	*All research centres*	*Regional research*	*Embu and Kakamega*
Institute head office	*All research managers*	*Assistant Directors interactions*	*Administrative and technical functions*
Programmes	*Crops and Soil-Water Management*	*Food crops, land management*	*3 food crops, 2 fertility management*
Research station level	*All researchers*	*All Research scientist*	*Researcher-scientists*
Projects	*Maize, integrated fertility management, weed*	*Embu and Kirinyaga projects*	*Nembure, Ndia divisions*

Data type/ source	Sampling population	Sample size	Study Unit
	management		
Farmer Research groups	*All groups in above projects*	*Participating groups*	*Groups in two divisions*
Farmer organised groups	*Purposive sampling*	*Purposive sampling*	*Rice, Khat +others*
School groups (function groups)	*All schools in District*	*Nembure, Manyatta divisions*	*5 schools*
Research managers	*Centre directors/farm management*	*Centre directors/farm management.*	*Centre dirtors/farm managers*
Administrators	*Accountants, Exec Asst*	*Accountants, Executive Assistant*	*Accountants, Exec Asst*
Individual scientists	*All scientist*	*Scientists in participatory Projects*	*Scientists in projects*
Technical assistants	*All technical asst*	*Technical assistants in participatory projects*	*TA in projects*
Support staff	*All drivers, labourers, guards*	*Support staff in projects*	*Staff in specific projects*
Agricultural Shows	*Shows within study period*	*Agricultural Shows within study period*	*Shows within study . period*
Field days	*Field days within study period*	*Field days within study period*	*Field days study period*
Open days	*Open days within study period*	*Open days within study period*	*Open days study period*

Data analysis

This consisted of a synthesis of records pertaining to Kenyan colonial and post colonial agricultural research for the period 1900 to 2000. The records were sorted chronologically to provide a sequence of the events involved in the emergence of the research institute as we see it today. Data from research centres was compiled to provide an insight into the operations of KARI, and the same was done for farmer data. The interview data coupled with direct observation provided a basis on which an interpretation of information flow was made.

5. Discussion and conclusion

The present chapter has provided the context within which the research for this thesis was conducted. Participatory approaches were introduced as a response to failed scaling out efforts associated with Green Revolution technologies in highly heterogeneous environments. A perceived reason was researchers' lack of information on farmers' circumstances sufficiently detailed enough to

formulate appropriate research agenda. But mere understanding of farmer circumstances is not enough, since researchers assumed that farmers had no real part to play in subsequent steps. Participatory approaches, consisting of various implementation methodologies, were then introduced with the aim of facilitating dialogue and establishing a more inclusive research process. While conceptually different from the conventional transfer of technology model, the new approaches have so far not yielded results better than conventional approaches. Empirical evidence continues to show minimum usage of 'jointly developed innovations', mainly restricted to pilot sites, and even then numerous modifications are first required, often of such scope that the reference by Mango (2002) to redesign seems appropriate. The mode of interaction and information exchange and hence communication between the farmers and researchers in the participatory research process has thus come under scrutiny. One possible explanation is the notion (as argued by Hebinck 2001) of alternative technological regimes, reflecting local social processes, harboured within niches, and at times amounting to counter tendencies. These counter tendencies reflect a presumed deficiency in conventional research to meet the aspirations of users. While there may be other factors as well, it is a hypothesis of this research that past occurrences as well as current research practice and organisation may have created a 'habitus' (Bourdieu 1997) constraining the mutual perceptions of researchers and farmers, resulting in failed communication and inadequate interaction. Continuities as well as discontinuities linking past and present research, and other agricultural development initiatives, have been proposed as a means to understand events over time, while an aspect of actor network theory (ANT) has been enrolled as a framework for documenting actor interactions. Since participation is a key concept, central to this study, critical debates over participation have been reviewed.

6. Structure of the thesis

Chapter 2 offers a review of the history of the Kenyan agricultural research, from colonial beginnings to the current period. This is divided into four major periods based on continuities and/or discontinuities. The periods comprise 1903 to 1953 (settler focus), 1954-64 (from Swynnerton to independence), 1965-1974 (Green Revolution technologies) and 1975 -2005 (farming systems and participatory research). These periods are characterised by various occurrences with direct or indirect bearing on the organisation and structure of KARI. The first two periods laid the groundwork for the present research infrastructure while the third period saw attempts to reorganise the research system to address changed realities on the ground. The second and fourth period are the ones where efforts were made to increase smallholder farmer involvement in

research processes; results are analyzed in relation to ongoing research activities.

Chapter 3 gives a description of the organisation of the Kenya agricultural research institute (KARI), from research headquarters to research centres and their mandates. It analyzes the interaction of the research managers with external and local donors, the connections with CGIAR centres, and the interactions among the research centres. The analysis also covers various fora convened to propagate the institute policies and views. An analysis of interactions among research centre scientists and between them and farmers and other stakeholders is presented. This analysis is juxtaposed to events in the research organisation mentioned in Chapter 2, and argues for certain operational changes to take place in research management, if requisite reforms are to be made in the research process.

Chapter 4 shows how research projects are formulated, implemented, and 'participation' is accommodated. Two research stations are used as case studies and evidences how researchers interact with farmers, both on-station and on-farm. Activities assessed include diagnosis, prioritisation, planning meetings, group selection, setting up of trials, field days, evaluation days, shows, conferences and station visits. The process followed, using a technographic perspective, and analyzed from the point of view of continuity/discontinuity.

Chapter 5 offers case studies of researcher-organised farmer research groups, together with an account of other farmer and stakeholder organised activities, to illustrate innovation and knowledge exchange processes with and without research and extension actors. The cases show that, unlike researchers, farmers are highly responsive to the local environment, as seen in various innovations marking a break or a discontinuity with previous operations. The heterogeneous networks that form as the farmers go about their activities are analyzed in the light of innovation systems bringing in relevant partners who add value to the process. The chapter illustrates the failure of the researchers and actors to 'translate' the other into their respective networks, partly because of the diverse goals and aspirations concerning technical and social innovations involved. Flexibility in the farmer system eludes researchers, owing to the formal structuring of their organisation.

Chapter 6 focuses upon three case studies of partners other than farmers and/or researchers. These are farmers and macadamia processors, farmers and a non-governmental organisation and a researcher-school collaboration (illustrating what can be achieved in the context of function-group initiatives). A study is done on how farmers organise around research technologies based

on their own self-assessed priorities. Five school agricultural groups involved in an activity illustrate technology development and testing and the utilisation of the outcomes in the classroom, as an example of the creative supplementation as a value-adding process. These case examples illustrate new kinds of partnerships of which researchers might take note.

Chapter 7 provides a synthesis, and argues that today's research has something to learn from colonial research where (arguably) farmer and researcher goals were more closely in harmony, and some scope for mutual exchange existed. It also analyses the implications of changes that never took place. The thesis ends by arguing for a re-examination of the policies that govern research practice today, to allow room for farmer and other stakeholders' views, in order to foster relevant research partnerships.

CHAPTER 2

CONTINUITIES AND DISCONTINUITIES IN KENYAN AGRICULTURAL RESEARCH AND EXTENSION: A HISTORICAL PERSPECTIVE

1. Introduction

An understanding of the agricultural research system in Kenya calls for an understanding of the history of agriculture which has coevolved with the country's social and political history. Operational procedures and contexts have dynamically responded to various events with subsequent changes or maintenance of the *status quo*, as this chapter aims to elaborate.

The account starts with the early explorers of the source of the Nile and the curiosity generated by their reports back to their home countries. The establishment of the White Highlands and a department of agriculture in Kenya in response to agricultural production constraints facing pioneer settler farmers formed the root of the research system under study. The research and extension staff of the department exchanged much field information with the practicing farmers. Indigenous farmers were excluded from the department's services, apart from a small elite of chiefs, colonial clerks and others located far from European settler farms. Establishment of multinational plantations and commodity foundations and boards happened later, to accommodate large-scale cultivation, research and marketing of cash crops like coffee, tea, pyrethrum, sisal and cereals.

The launching of the Swynnerton plan marked a major discontinuity in the research and extension system in Kenya, with an effort to focus on research and extension for the African reserves, leading to the additional establishment of general investigation research stations to complement the commodity stations serving the European areas. The research and extension services, however, continued to exclude the majority of Africans, with an exception of a small group of "progressive farmers" who were showcases for improved technologies, which were then expected to diffuse to the rest of the farming population. This approach continued into the post-1963 independence period, and translated into the "contact farmer" approach, under the World Bank promoted Training and Visits (T&V) extension system, followed by the "group farm concept".

A review of the research system was conducted in 1968 by the Rodenheiser commission and the break up of the East African Community led to the absorption of Kenyan research staff from the former East African Agricultural and Forestry Research Organisation into the Scientific Research Division (SRD) of the ministry of agriculture in 1977. A Science and Technology Council was then formed to handle the legal procedures necessary to create a semi-autonomous organisation, leading to the establishment of the Kenya Agricultural Research Institute based at Muguga until

1987. The 1977 reorganisation occurred at around the same time as the establishment of the economics unit in the SRD, which then introduced the farming systems approach to research, aimed at analyzing farmers' constraints and opportunities in different farming systems (a further apparent discontinuity in the research approach).

This then gave way to participatory research approaches aimed at involving the farmer in the joint development and testing of technological alternatives. In 1986 a rationalisation of the research stations occurred, and 12 national and 11 regional research centres were established, funded by multi and bi-lateral donor with the launch of the National Agricultural Project (NARP) phase 1. Despite these changes, continuity was also apparent, as will be described below. The present chapter therefore elaborates a number of continuities and discontinuities experienced over time in the public agricultural research in Kenya, as a product of the broad political, financial and social contexts within these periods.

Early explorers, railway construction and settlers

An entry in Dr Ludwig Krapf's diary dated ''Mombasa 21st Jan 1850'' presented to the Royal Geographical Society in 1882 reads:

> *On the afternoon of my departure from Kivoi's (his host] hamlet, I got a fine view of Mount Kenia which I saw stretching from the East to the North West. On its back I saw two horns towering heaven wards and now I understood why Kivoi could say that Kenia was greater than Kilimanjaro in Chagga and was the second snow mountain for snow was on the horns or peaks as we may call them… Furthermore, I am fully convinced that a traveler must in this direction reach the sources of the White Nile… it is probable that this river or a branch of it rises in the North of Mt Kenia.* (Krapf 1852)

On the evening of 11th April 1892, Gedge Enderson read a paper to the monthly Royal Geographical Society meeting about Captain Dundas' exploration of the river Tana, and at the end of the paper a discussion ensued, of which the following is an extract:

> *The discovery of snow on Mount Kilimanjaro in 1849 by Rebmann caused quite a commotion in the geographical world….and the discovery of Mt Kenia a second mountain on December 3rd 1849 by Dr Krapf from a hill in Kitui... The second European to view the mountain from within 25 miles was Joseph Thomson who right now is stretched upon a bed of sickness brought on by the hardships of those African adventures that brought him so much fame.* (Gedge Enderson 1892)

The expedition by Krapf reported to the Royal Geographical Society, and the accounts of Joseph Thomson's expeditions, sparked curiosity about the Eastern part of Africa. Thomson - whose name is immortalised in the Thomson's Gazelle - described a large, fertile, unoccupied, wildlife-abundant, land (Thomson 1885).
Krapfs' communication to his homeland was perceived to be a threat to the remittance of tribute to the Sultan of Zanzibar by the inland tribes. This concern was communicated through Major Hammerton, the British consul in Zanzibar. In

communicating the Sultan's displeasure to Krapf, Hammerton asked the German to keep to his missionary work. Krapf wrote in his diary:

> *It is a matter deeply to be deplored that science and politics cannot yet go hand in hand. And if as a missionary you try to communicate what you know, you are told keep ye silence or we will put you down… what business do you have communicating your geographical knowledge?* (Krapf 1852)

Controversy also emanated from England where certain remarks made by one Mr Cooley in a pamphlet titled ''*Inner Africa laid open*'' ridiculed Krapf's accuracy. Krapf then wrote to the Royal Geographical Society:

> *I therefore cling to my earlier opinion that the source of the Nile will be found in the vicinity of the Equator where I placed it, whatever may be the objection of Mr Cooley.* (Krapf 1854)

The arguments about the Kenyan interior captured in the diaries of these early explorers spurred great interest to discover the source of the Nile and curiosity to view snow capped mountains on the equator. This led to further exploration, and culminated in the Scramble for Africa between Germany, France and Britain, resulting in the 1885 Berlin treaty that divided Africa into various European spheres of influence. Britain and Germany agreed to recognise territories for development, upon which Kenya was declared a British protectorate in 1895 and later, in 1920, a Crown Colony. Western Kenya was not, however, part of the Protectorate and was administered by Britain from Uganda until 1920, when it became part of Kenya (Van Zwanenberg 1975, Leys 1975, Sorrenson 1968).

An Imperial British East African chartered company was established in 1888 and had offices in Zanzibar facilitating trade between the East African coast and Britain. It was given the concession to administer the new protectorate. Trade was mainly confined to the coastal region but was later extended to the interior (Munro 1987). The Sultanate of Zanzibar extended inland for "ten sea miles" (also known as the '10 mile coastal strip') with land ownership a contested issue to the present day due to a squatter problem that every successive Kenyan government has promised to resolve, without success as yet (Kanyinga 2000). To enhance communication with the interior - and according to Leys (1975) 'to provide strategic access to the headwaters of the Nile' - construction of a railway line was proposed and initiated.

Railway construction

The construction of the railway line from Mombasa to Lake Victoria started in 1896 through loan funds provided by the British treasury. The line reached the foot of the Rift Valley escarpment in 1899, where a base camp and supply depot called 'Mile 327' was put up. The camp initially assumed the aspect of a rustic village, then a shanty town, and later developed into a meeting point for adventurers, hunters and travellers from all over the world. This is what is known as the city of Nairobi today. The railway reached Port Florence (Kisumu) in 1901 and eventually Kampala (1931). The opening of the railway had an immediate and tremendous impact on travel, and economic development of the territory as the few pioneer settlers who had already

settled were able to transport their agricultural produce and supplies to and from Mombasa. The revenues raised were at first inadequate to repay the British government loans and the grant-in-aid needed to finance the administration of the British East African colony. This meant that a better financial solution had to be found, and hence the millions of acres of land that appeared idle, as reported by earlier explorers, close to the railway line, had to be made productive (Leys 1975). This land belonged to Kikuyu and Masai families driven away by a series of epidemics. Some of the land was being rested under shifting cultivation or was under communal grazing, so only appeared empty (Kershaw 1991). Apparently un-owned, this land was alienated by the colonial administrators for occupation by settlers.

The legal instrument was the 1899 unoccupied land regulation that converted all unoccupied land in Kenya to Crown Land (Cone and Lipscomb 1972). This was further consolidated by the 1902 ordinance that converted both occupied and unoccupied land to the British Crown. After the First World War, the Crown Lands ordnance was modified to reduce the minimum requirements for improvements on alienated land and to extend the leases from 99 to 999 years (Gutto 1981). The settlers were to invest capital and produce crops and the railway would transport them to the coast, thereby earning revenue, while imports from abroad would attract tariffs. Settlers came from Britain, Australia and South Africa, among other countries, and established an area of intensive European-style farming subsequently to be known as the White Highlands.

The White Highlands and the native reserves

Age old traditions of migration of local peoples to new, uncleared and unoccupied land was curtailed upon declaration of the British Protectorate, and any apparently unused land was gazetted and alientated. Raiding and looting – among the established cultural practices of various tribes - were then prevented through military pacification campaigns. A period of land annexation followed in response to settler invitations. These invitations, following railway completion, constituted a second of three waves of settler occupation. The first wave was the pioneer group, who moved in following favourable reports to the Royal Geographical Society, while the third wave consisted of ex-servicemen from the First and Second World Wars who were given land after their military service terminated (EA commission 1925).

As pointed out earlier, the settlers assumed, or were made to believe, that all unoccupied land was vacant, although in fact (as mentioned earlier) the unoccupied land belonged to local peoples who had temporarily evacuated the area due to locust infestation, famine, rinderpest and smallpox epidemics (Kershaw 1991). Vast areas of previously cultivated land were quickly reclaimed by the equatorial vegetation. For the few occupied lands which the European settlers desired, a nominal fee was paid, according to settler custom, which departed considerably from the understanding of the local tribes. In one documented case, a 1600 acres piece of land was purchased for 60 goats (Githieya 1997). The settlers assumed that they had purchased the land but

the locals perceived that they had leased it for a period, since their religion prohibited its sale to non-tribe members. When the locals attempted to move back on to their land in later years, conflict arose between the parties, and this contention and distrust continued for decades thereafter.

In some cases, treaties to possess land were entered into between ''self declared spokespersons'' of the tribes and the prospective occupier, and in so doing, a whole clan's land would be taken away. As demand for land increased, the colonial government enacted the Crown Land Ordinance in 1902. Under this law the commissioner was granted full authority to alienate crown land:

> *The Commissioner may grant leases of areas of land containing native villages and settlements without specifically excluding such villages or settlements but land in the actual occupation of natives at the date of the lease shall, so long as it is actually occupied by them, be deemed to be excluded from the lease.* (Crown Land Ordinance 1902)

This ordinance did not, however, define the meaning of the phrase ''actual occupation''. It was therefore at the prerogative of government officials to decide whether land was actually occupied. The officials acted in accordance with their own assumptions and settler desires. This was in many cases in total neglect of the provisions of the ordnance, an example being the excision of the Nandi Reserve as a result of the ex-soldiers settlement scheme in 1919 (EA Commission Report 1925). The same approach was used to acquire land for most of the agricultural research stations, where whole families were evacuated and settled in the Native Reserves. The rules were enforced by appointed local chiefs and collaborators, and this caused local disdain for administrators by the local population. The 1902 Ordinance exists in the Kenyan constitution in a revised form up to the present day, and has been used by the Commissioner of Lands to excise government land, including research stations, and assign it to private use (Ndungu commission 2003).

As shown in Table 1 below, the settler population and areas of settler alienated land increased over time.

Table 1: White settlement in the Kenyan Highlands

	1903	1915	1920	1934	1942	1953
Settlers (approx.)	100	1000	1200	2000	3000	4000
Occupied acreage	*	4.5m	3.1m	5.1m	6.3m	7.3m

(Source: Leys 1975, p29)

While initially the alienation of land was confined to the Central Kenya highlands, South African (Afrikaner) and Rhodesian farmers, on persuasion by the colonial administration, moved in and settled around Eldoret, and these are the ones who laid the foundation for the colonisation of the western part of Kenya (Huxley 1957). Their occupation of this land denied the Nandi and Maasai tribes access to the productive northern pastures to which they used to migrate, with the former being locked up in a reserve and the Maasai driven to the south.

As of 1930, the White Highlands covered 19% of the forty thousand square miles of Kenyan land receiving over 30 inches of rainfall per annum (Wolff 1974). In the same year the Carter report on the land situation in Kenya recorded that Europeans occupied 6.5 million acres of an estimated 40-45 million acres of arable land in Kenya, while the average population density in the Central Kenya reserves was estimated at 283 persons per square mile (Ochieng 1977). This overcrowding in the native reserves formed a major grievance - among others such as overstocking and corresponding overgrazing, and the extraction of forced labour from the native reserves - marking another phase of Kenya's agricultural history (Odinga 1967, Cone and Lipscomb 1972, Mbithi and Barnes 1975).

Labour in the farms and the problem of social order

According to Leys (1975), some of the Europeans who acquired land had neither the knowledge nor the capital to farm it differently from the Africans on their land. The farms were huge, averaging 2,400 acres per occupier by 1932, and labour was needed, which had to come from the Africans, paid low wage to maximise profit. The Africans were not motivated to work in these farms and labour bottlenecks then ensued. The colonial administration had to compel the Africans to work, and this was done partly through taxation, partly by force and partly by preventing access to profitable cash crops which would have enabled payment of taxes without working for wages. A hut tax was introduced, whereby every head of a family had to pay tax for every hut owned; the number was customarily equivalent to the number of wives, a proxy for wealth.

In 1907 a department of native affairs was formed to coerce people to work for private employers, and in 1910 the tax bracket was widened to extend to all males over sixteen years (liable to a poll tax). Teenagers were therefore forced to seek employment in settler farms, and this subsequently increased labour available to Europeans, besides earning revenue for the government. Further legislation, like the "Masters and Servants Ordinance" was enacted, binding the African worker to serve a contract, with any breach resulting to imprisonment. After 1918, a Resident's Labour Ordinance was introduced, that converted the squatter labourer into a serf who had to work on his master's plot for a minimum of 180 days in a year. By 1925–27 about 40% of all eligible males in the two largest tribes (Kikuyu and Luo) were working for Europeans, and as Brett reports, generating 60% of the total taxation in Kenya. As reported by Wellbank (1938), the male African was regarded as an accessory in the economic life of the colony, with his role being primarily to serve as a low wage labourer on European farms.

As time went by, the local population became accustomed to a money economy, and an attempt to reduce the monthly wage rate resulted in a general strike and major demonstration. This threatened operations not only in the farms but in the rapidly expanding Nairobi city, where rickshaw operators refused to ply their normal routes,

in one of the earliest instance of resistance and political activism finally culminating in the Mau Mau rebellion (Furedi 1973).

As may be observed from the above account, the labour problem was solved through taxation and enforced through various pieces of legislation. By so doing, the colonial administration was also able to collect revenue. By enforcing a ban on Africans cash crop production, a European monopoly was created. However, a major problem still remained, and this was how to solve tropical pests and diseases and devise best agronomic and other management practices for newly introduced crop varieties and livestock breeds.

Disappointing experiences

On arrival in Kenya, a big assumption by the settlers was that the fertile soils and highland climates similar to their home countries, coupled with their agricultural skills, would translate into high production. It was at first assumed that all that was needed was to transfer crops and animals and agricultural skills to the newly acquired land. Little initial effort was made to understand African farming practices, and as shown by various documents an assumption prevailed that getting involved with the local production system was a recipe for contaminating and thus lowering the quality of Kenyan produce (Wasserman 1974). It was not yet understood that African agriculture was one that over time successively spread across the savanna and forest while remaining resilient to local environmental challenges, reflecting a long-term history of constant adaptation in the face of ecological stresses and population growth (Harlan, De Wet and Stemler 1976, Sutton 1989).

Local practices were long ignored by a settler-dominated agricultural service. In part this was because a unique set of circumstances at the end of the 19th century involving spread of externally-introduced pests, diseases and pestilence (Ford 1980) had driven off the major populations of Kikuyu and Maasai in the central highland region. The land offered vast potential in terms of space, climate and soil fertility, but it also challenged the Europeans with the same disease and pestilence driving out the native population. The settlers fought this battle largely by trial and error, at tremendous investment cost, as crops and animal stock repeatedly died off and had to be replaced. Wild animals foraged in the cultivated fields at night, and often destroyed acres of grain in one night's feeding. Insects and drought sometimes wiped out entire harvests. Pedigree breeding cattle, imported from Europe at great expense, were attacked by fever. Worms contracted from wild animals, foot rot, and unidentifiable grubs attacking the eyes, killed off sheep by the hundreds. The lives of the settlers were plagued by continual heartbreak and ever increasing debt.

Further illustrations of the losses incurred include the Arabica coffee planted in 1901 by the St Francis mission on volcanic soils resembling those of the Ethiopian highlands. The trees were seriously attacked by coffee berry disease and various rusts, and also by mealy and antestia bugs. There is also the case of Lord Delamere's wheat in 1906 which was devastated by rust, thus forcing him to employ his own

wheat breeder (Suttie 1970, Odingo 1971, Ruttan 1987). Horticultural crops introduced for kitchen gardens were attacked by many new pests, but also brought in exotic pests with no natural enemies. Besides tropical pests and diseases, exotic diseases were introduced, such as rinderpest and other temperate diseases. However, consistent with the dauntless spirit of pioneers throughout history, the settlers hung on, but increasingly feeling an urgent need for support, thus leading to the establishment of the department of agriculture.

2. Department of agriculture and research

The department of agriculture was set up in 1903 and was responsible for policy, technology development, extension and the regulatory services needed to stimulate agricultural production (Clayton 1964, Suttie 1970, Heyer et al. 1976, Ruttan 1987). It was also responsible for development of water resources and had a veterinary department responsible for animal health, breeding, marketing, maintenance of stock breeding centres and artificial insemination. Following the introduction of the department, experimental farms were established, and these marked the first steps towards establishment of an agricultural research service and infrastructure.

Agricultural research services

The first government experiment station farms were established at four locations: Mazeras in Coastal Kenya, Kabete in Nairobi, Naivasha near Nakuru and Kibos in the Lake Victoria region. Later, the Kabete farm and Mazeras sites were re-located after consultations with department staff and practising colonial farmers. This is an indicator of the working relations of the department with the farmers. The Mazeras experimental station served the coastal zone while Kabete served the Central Kenya highlands, Naivasha served dairy farmers and Kibos served sugar cane and cotton farmers in the Lake region. These four stations formed the core of experimental capacity from 1908 to 1914. Their location next to the railway line meant easy access by European settler farmers and served a testing purpose for crops suitable to the areas they served. The department farms supplied planting materials to planters, settlers and later to a lesser extent to selected native (elite) farmers. On-station experiments conducted in station farms were supplemented by trials conducted by settler farmers following the model in use in the United Kingdom, where farmers used to do their own tests. To further encourage the practice, the department of agriculture proposed to pass legislation whereby any farmer who conducted an experiment on his farm and produced a sound technology would receive free seeds free from the department (Brown 1968).

An entomology laboratory was opened in 1908 at Kabete and the first government entomologist was appointed, while at the same station a rust resistance wheat programme was started, and a Sub-Station set up at Njoro in 1911. In the same year, a tobacco officer was appointed to replace the one shared with Uganda from 1908. In 1913 a flax expert was brought in from Belgium, and a coffee planting inspector was

appointed in 1914. Farming activities, together with research and extension services, continued uninterrupted until the outbreak of World War 1 in 1914. The outbreak of the war led to conscription of the various agricultural research professionals into the war effort. Veterinary surgeons were needed to provide health services for cavalry horses and bullocks extensively in local campaigns while hydrologists provided guidance in the search for water for the troops in deserts while meteorologist and entomologists also provided their skills to the war effort (The Independent 2005). African troops were also recruited as carriers, with longer-term implications for the political sensitisation of local populations.

On resumption of research services, a horticultural officer was appointed in 1919 and the first plant breeder was appointed in 1921. The pre-war Kabete experiment station was closed down in 1922 and a multidisciplinary agricultural research and advisory service laboratory was established in the former Scotts war sanatorium, which became the Scotts laboratories, with a 65 acre land endowment for conduct of research on pathology, mycology and entomology. This remains the site of present day National Agricultural Research Laboratories, which became the eventual nerve centre of the national research services, catering for all crops. As a lasting memory, two famous gourmet Kenyan coffee varieties, SL 34 and 28, bear the initials of the laboratories, and one of the oldest coffee trees in Kenya still stands outside the administrative block. In a striking anticipation of the participatory revolution to follow some 75 or more years later, the director of agriculture remarked that necessary experimental work could be undertaken in cooperation with the farmers in their farms (DOA 1922)

In 1924, a chemistry department was established in the Scotts laboratories to track the status of soil fertility under continuous crop production in settled areas. The first coffee trees were planted in the same year and the entomology, pathology and chemistry sections increasingly became involved in coffee work (DOA 1924). This continued until the establishment of the Jacaranda coffee research station in 1948. A plant breeding station was opened in 1927 at Njoro, continuing the work that had been started at Lord Delamare's farm. Other stations were opened at Thika (1937) for sisal, Molo (1944) for pyrethrum, Jacaranda for coffee in 1948, followed by more stations in the 1950s (Map 1).

Despite expansion of the major research sites, the department's research staff remained at about 40, comprising 25 full-time researchers, with the remainder being part time researchers, agricultural officers or laboratory technical staff. The researchers were closely linked with the advisory and extension services, and were in turn closely linked, socially, with the small contingent of settler farmers. The researchers were well aware of the settler farmers' problems, which were addressed in research programmes operating within the framework of government emphasis on export crops, but limited by staff savailability.

As mentioned before, forced evictions to pave the way for the European settlers and government facilities increasingly created tension between the Europeans and the

local population. Part of this had to do with the misunderstanding by both parties about the nature of African land tenure mentioned earlier, but further grievances adding to tensions included forced labour, taxation and prohibitions on growing of cash crops. As reported by Wasserman (1974), African farmers were allowed to grow tobacco, cotton and rice but not coffee, until the 1930s when coffee cultivation was allowed in Meru, Kisii, and Embu areas, far removed from the European plantations. The perception at the time was that lack of proper care for the coffee would lead to poor quality but a 1960/61 price of £302/ton for coffee from European areas and £360/ton for African areas contradicted this perception (Development Plan 1966-70). The prohibition was therefore to ensure African labour was available on an uninterrupted basis as coffee cultivation would enable them to pay taxes through coffee sales rather than wage employment. and the same logic was applied to marketing of cattle in African areas.

Other sources of grievances included the dishonoured promises of compensation for African troops in the World Wars while European ex-servicemen were rewarded with extensive pieces of land (East African Commission 1925). The camaraderie in the war also exposed the carriers to the hollowness of myths of European superiority which combined with contact with other cultures, heightened political awareness. By the 1920s, local activist groups, like the Kikuyu Central Association, the Young Kavirondo association, and others were formed (Furedi 1973). The government underestimated the political influence of these groups, but as witnessed in 1923, a violent confrontation ensued, when Harry Thuku, a radical activist, was arrested, following which several people were killed when colonial police fired live bullets into the crowd outside the Norfolk Hotel (Furedi 1973). This activism continued, even though the colonial government played the issue down, until the outbreak of the Mau Mau rebellion and declaration of state of emergency in 1952.

As political activism began to build up, an elite African group was emerging in the reserves, courtesy of the European missionaries who tutored them in reading and writing skills as well as introducing them to the operations of a monetary economy. This elite group was encouraged to fence off former communal land for their private use, and served as colonial state chiefs and headmen, collecting taxes and executing punitive measures for non compliance. They also served as court interpreters and clerks, teachers and nurses, as well as Christian preachers (Mutiso 1975, Nganga 1981). Such elites were often referred to as '*watu wa misseni*' (mission people) while those who stuck to the traditional ways were called '*watu wa blanketi*' (blanket people) owing to their blanket attire. The mission people were the first to receive any development project and later became progressive farmers. As reported by Hebinck (1990), a native indirect rule policy was adopted in the mid 1920s with an aim to co-opt these emerging indigenous educated elite into the colonial state administrative apparatus. Local Native Councils (LNCs) were created and represented the colonial government's first attempt to provide an administrative agency that would secure a certain amount of African development without drawing resources from central government revenue, mainly expended in the settler areas.

The African chiefs and headmen collected taxes and had an additional role of rallying support and organising labour gangs for road construction within the Reserves. District Officers acted as *ex-officio* chairmen of the Councils with an absolute veto power securing central government control of the activities of the LNCs. In 1921, Native Trust Funds were initiated to finance local development projects in the African reserves (Cone and Lipscomb 1972) and in 1922, selected Africans were allowed to produce for the market. To support this effort the government funded the training of African agricultural extension staff to enhance demonstration of improved farming methods and use of good quality seeds. By 1935, the Marketing of Native Produce Ordinance was enacted, with the apparent aim of streamlining marketing for the smallholder African commodity producers, who had by now crystallised into a formidable group. The indirect rule policy was adopted with an aim to co-opt these emerging indigenous educated elites and this created opportunities for some Africans to occupy political positions within the colonial state apparatus.

As Hoskinson (1997) reports, in December 1935 a group of African maize farmers, representing growers from Broderick Falls, Kimillili, and Butere, lobbied, with the support of the Kenya Farmers Association, the District Commissioner at Kitale for permission to sell their collective crop of roughly 30,000 bags of maize to the Kenya Farmers Association. This, according to the growers, was because of the inadequate return of 2 Kenya shillings per bag (1$=70Kshillings) from the Indian traders to whom they had sold in the past. The Kenya Farmers Association was willing to buy the maize at a negotiated price and to use its European and American connections to market it. The Association agreed to pay 4-4 Kenya shilling per bag to the African growers and the scheme was given the full support of the Agricultural Department. To support more farmers to produce, the government funded training of African agricultural extension staff to enhance demonstration of improved farming methods and the use of good quality seeds. The 1935 Marketing of Native Produce Ordinance purported to facilitate African smallholder commodity producers, but as Govereh et al. (1999) argue, the strategy also protected the market share of the settler farmers through controlling amounts, marketing distance and types of produce that could be marketed.

Following the outbreak of the Second World War in 1939, an Increased Production of Crop Ordinance was enacted to boost European Settler production for war purposes. The ordinance assisted importation of machinery at subsidised prices as well as soft loans for operational expenses (Cone and Lipscomb 1972). At the end of the war (1945), the European Agricultural Settlement Board (EASB) was created to facilitate subdivision of large-scale farms, to create space for ex-servicemen. A European Revolving Settlement Fund was launched in 1950 and this, and other facilities, including technological advances, enhanced production efficiencies in European farms leading to massive lay-offs of the African labour force whose return to the reserves further aggravated pressure on land and consequent political agitation (Odinga 1967).

The first ten year development plan for the African areas was launched in 1946 in response to the tension building in the African reserves. The plan undertook to establish an agricultural investigation station in each of the main provinces and a pasture research scheme for the colony to be funded through a mixture of local and Colonial Development and Welfare Fund resources. Among the stations established was Embu (in 1952) for crops and livestock in Central and Eastern Kenya, Molo for horticultural research (1947) and Olo-Joro-Orok (1947) for high altitude crops and livestock.

Following political agitation in the reserves or unscheduled areas for grievances alluded to earlier, a state of emergency was declared in October 1952 which was then followed by a Royal Commission constituted to look into the problems of the African areas. In their report, the commissioners noted that poverty prevailed in the African territories and recommended that an agrarian revolution should be launched to alleviate the deteriorating conditions. The revolution came in 1954 in the form of the Swynnerton Plan (Swynnerton 1954, KNA 1953). As Leys (1975) states, the Swynnerton Plan was a direct response to the emergency, as it was clear that keeping the reserves as subsistence foodstuff sources for low paid wage workers and their families was no longer practical; new wealth had to be generated for the burgeoning population. This, according to Swynnerton (1954) meant a reversal of government policy whereby rich Africans would acquire more land while the poor would acquire less, thus creating a landed and landless class seen as normal in the agrarian evolution of any country. This represented a major discontinuity in Kenyan agricultural policy, by e.g. providing loans for African farmers to invest in agricultural production, and in making provision for consolidation and registration of land, thus legitimising the land enclosure process starting as early as 1920 in reserves. The Swynnerton Plan and the land reforms it proposed had immediate and dramatic results, with output from smallholdings rising from £2.5 million (sterling) in 1955 to £14 million in 1964, a 55% increase (Leys 1975).

3. The Swynnerton plan and local farmers (1953 -63)

In a letter dated November 1953, acting on the Royal commissions recommendations, the Member for Agriculture wrote a letter to Mr Swynnerton asking him to write a five year plan to intensify development of African agriculture. In a paper delivered to the Royal African Society in London on May 2nd 1957, Swynnerton stated that:

> *The royal commission advised us to concentrate on the high potential lands rather than those which would not bring in much returns.* (Swynnerton 1957)

In the same paper he indicated that the plans were made for 15 to 20 years, since experience had shown that five year plans were impractical for agricultural development. In effect, Swynnerton plans stretched from 1954 to 1974.

One of his recommendations was the setting up of research stations in all the major regions and the posting of additional extension staff to the African areas.

Agricultural investigation centres were opened in each of the main provinces in the Lake Victoria region (Nyanza), Central and Coast provinces to cater for the African areas, but deriving their technologies and information from the existing commodity research stations (see map). Substations of these investigation centres were also opened to cover the different agro-ecological zones or to investigate specific problems. The investigations conducted were on fertilizers, irrigation, tree crops, entomology and pasture, among others. It is worthwhile to note that these investigation stations were jointly managed by researchers and extension officers from the respective districts, and this shortened the time lag of information flow between researchers, extensionists and farmers.

Besides research, the report also recommended agricultural education in the African areas to cover different needs. This education was to be targeted to farmers, their children at school, and to school teachers, especially those undergoing training. The farmers were to be reached through short courses at farm institutes. Children at schools were to be reached through their teachers in the teacher training colleges. The teachers were to teach farming methods to the children and every agricultural instructor was expected to adopt a school.

Training of assistant agricultural officers at graduate level was proposed together with possible incentives to make the training more acceptable. These included good salaries and other incentives to make the profession as competitive as other attractive and preferred professions. In one communication it was made evident that many newly educated Kenyans were not very keen on following careers in agriculture (Swynnerton 1954). They considered it to be an inferior vocation. Careers in administration and other white colour jobs were preferred.

Land reform was also a recommendation in the plan; adjudication, demarcation and registration were advocated. Before the coming of the settlers, African land - especially in Central and Eastern Kenya - was secured by ''first occupation", and the clans ensured that individual families had small plots in diverse ecologies and environments. This was planned in such a way that risks were spread out across environments and micro climates to cater for seasonal weather patterns, soil variability and even topography. As Brouwers (1993) reports, micro variability is often exploited by smallholder farmers because for each weather condition there are some pieces of land where crops will perform well, and hence field heterogeneity is regarded as an asset. However according to Swynnerton, as reported in his 1957 paper:

> *Through inheritance and a bad system of land tenure, holdings have become fragmented and an individual may own as many as 10 to 30 scattered plots over a radius of five or ten miles only an acre in size… an instructor may take one week getting round the plots and if you try to consolidate the holdings they cry out you are after our land.* (Swynnerton 1957)

These land parcels came in different shapes and sizes and this raised concerns with the administrators. However, the overarching concern was that with small scattered units it was difficult to apply modern farming practices, and especially to cart and

apply manure and fertilizers. Land adjudication, consolidation and registration were therefore initiated with an aim of enabling the:

> *The African farmer to have access to medium or long term agricultural credit by offering his land as security to authorised bodies* (ibid).

Unfortunately, social problems such as inter-family and clan rivalries, court petitions, and inadequate financial, human and logistical resources have all contributed to delays in completing this exercise and continue to date (SRA 2004). In the meantime, social and environmental dynamics have changed over the years, and the effects of these developments on ongoing agrarian projects cannot be overemphasized.

As was envisaged in the plan, agricultural credit was made available to the African farmers to engage in cash crop farming, and as pointed out earlier, preferential treatments was given to those elites supportive of the colonial government, including farmers who allowed their land to be demarcated. This created a social distance between such people and the rest of the community, and yet these are the farmers who were supposed, for many years, to serve as contact farmers for new technologies. The same may be said to be happening today when collaborating farmers in participatory research activities are provided with inputs, or are ferried to various places on exchange visits using the institute's resources viewed as rewards by other farmers. This creates a social distance between such farmers and the rest of the community (cf. Kiptot 2007).

Implementation of the Swynnerton Plan recommendations continued until after the country's independence in 1963, with research infrastructure and staff numbers being expanded.

Post Independence research coordination and the Scientific Research Division

In the preface to a 1963 compendium of research in Kenya, the Chief Research Officer, a Mr. Hainsworth, wrote:

> *Kenya is fortunate in being able to finance agricultural research on an increasing scale since 1908 when research began modestly... the research division is now one of the largest of its kind in Africa employing 150 officers and a commensurate subordinate staff... research units were established in 23 centres spread over all the main ecological zones of Kenya.* (E. Hainsworth – Chief Research Officer 1963)

This network formed the framework of the present day research centres, with the exception of five cash crop commodity facilities (for coffee, tea, sisal, pyrethrum and cotton) placed under separate research and marketing bodies. The Chief Research Officer was in charge of research work and the Ministry headquarters controlled fund allocation, recruitment and financial operations, but not guidance on research programmes. It was left to the station heads to devise programmes in line with broad national objectives to optimise agricultural production.

Up to independence, and shortly thereafter external funding for research came through the UK government in line with colonial policies and agenda. Other donors

were also included, but to a small extent, and mainly providing short-term budgetary support, later turned into specific short-term projects in line with donor policies, and this pattern has continued to date, though with non-British donors playing an increasing part.

Coordination of research caused concern at the headquarters, and in 1968 a commission led by one Mr. Rodenheiser was set up to study the situation. The commission recommended creation of an agricultural research division to be headed by a director, with various coordination structures to advise the ministry. It also recommended all general investigation centres, bar one, to be placed under extension, to serve as demonstration sites but to be made available for research work. An agricultural research advisory council was subsequently set up in 1969 to deliberate on the commission's report but rejected most recommendations and modified others (CG 2000).

Agricultural research as a division within the ministry of agriculture augured well for the agriculture sector since research findings were shared between research and extension staff. Indeed in some cases, some research investigation sites were supervised by divisional extension officers who reported directly to the officer in charge of the research stations (Brown 1968).

Concurrently with changes in the department of agriculture, there were others on the political front, involving tensions between the three East African community countries unable to continue to work together as a block. The break up of the community affected various common services, including research, and it was this event that heralded the establishment of the Kenya Agricultural Research Institute.

The break up of the East African Community and the formation of KARI

Following the break up of the East African Community in 1977, Kenyan staff of the regional research organisations had to be redeployed, but this was impossible under government operational procedures. A national council for science and technology was established under which the necessary legal frameworks were put in place to handle the emerging situation. Staff of the former East African Agricultural and Research Organisation (EAAFRO) and the EA Veterinary Research Organisation (EAVRO) were linked up with the SRD under a new Kenya Agricultural Institute with headquarters in former EAAFRO offices at Muguga. The institute was launched under section 17 of the Science and Technology act (cap. 250) of 1979. Technically, this was the year that the new research institute came into being, but KARI was not formally launched until 1987, when a physical shift from the ministry of agriculture ''Kilimo'' headquarters to Kenya House near the University of Nairobi completed the launch. Offices later shifted to the National Agricultural Laboratories (former Scotts Agricultural Laboratories) on Waiyaki way, and then to the present site on Kaptagat road in 1996. These shifts re-enacted the three shifts by the research division in the early part of the twentieth century. Metaphorically, a gap was created by the shifting of offices from the former Scientific Research Division third floor offices in

'Kilimo'house and the new KARI offices in down town Nairobi, and this was widened by the formation of a Ministry of Research Science and Technology, which then became the parent ministry of all research institutes in Kenya.

Ministry of Research and Technology and a memorandum

While the new ministry was expected to streamline the conduct of scientific work in the country, it created a problem for the up-coming KARI, which was now technically de-linked from the ministry of agriculture. This was a bureaucratic hurdle created by difference in operational procedures between the ministry of agriculture and the new corporate body. Joint research-extension activities under the farming systems research approach introduced four years earlier could not be conveniently conducted. A Memorandum of Understanding was signed between the permanent secretaries of the two ministries. This MOU spelt out terms under which joint activities were to be implemented and specified a budget to cater for joint research extension activities provided under the National Extension Programme. Each regional centre became the custodian of a share of these funds, and research extension liaison officers (RELO) positions were established in both research and extension services. The location of the funds in the research centres became an issue, with expenses incurred in the course of normal extension duties being charged to these funds. Flow of funds was discontinued after a while, and the MRST was later split up into Science and Technology components and placed under the ministry of education. All research institutes then reverted back to their parent ministries.

However, the discontinuation of this administrative arrangement did not amount to a discontinuation of procedures introduced through the MOU. Attitudes of researchers and extension staff alike continued to affect their operations, and this also coincided with the weakening of extension services owing to reduced funding. Concurrent with the administrative upheavals and a new research approach were other changes in the approach to development, where the central government sought to establish a decentralised development strategy in the form of the District Focus for Rural Development (DFRD). The farming systems research approach, with its emphasis on local farm level activities, was perceived as an ideal strategy to operationalise the new central government thinking within the ministry (Thompson 1995).

Introduction of farming systems research and the development plans

The agricultural development policy of independent Kenya followed the colonial one, with policies modeled on the plan to intensify agriculture . In the 1970-73 plan, cash crop production and a commitment to increase resources for peasant and pastoral farming systems, was proposed. In this development plan the government's commitment to intensify research for smallholder farmers was clearly indicated.

The 1974-78 plans emphasized commercial smallholder production but allocation of resources was to high value commodities - tea, coffee, hybrid maize, pyrethrum,

horticultural crops, sugar and dairy. The 1979-83 development plans proposed to spread benefits of economic growth to the rural population in addition to increasing cash crop production levels. Concern was raised on how to reach smallholder subsistence producers including those occupying the arid and semi-arid lands (ASALs). All these plans expressed the government's intention to reach the rural peasant farmers, but policies and resources were in fact directed mainly to commercial farmers, especially those in high potential areas just like the 1953 commission had advised.

It was during this period that farming systems research was introduced into the research division, and was found appropriate because all ministries were required to provide strategies to operationalise the new decentralised development strategy; technologies adaptable to smallholder mixed farming were not at that time available for immediate adoption. The ministry found a convenient and ready-made strategy in the farming systems approach, but no government budgetary allocations were made to provide for the consequences. This partly confirms Richards (1983) statement on undertaking of reforms which reinforce favored policies. Proposed reforms remained official but implementation became an issue, as illustrated by efforts to institutionalise farming systems research.

Farming systems and farming systems research

Farming systems as defined in Chapter 1 refer to specific combinations of resources available to the farmers to meet their goals and objectives (Okigbo 1979). Farming systems research is then aimed at understanding farmers' constraints, resources and aspirations in combining these resources. Research results are then expected to provide a basis for joint development and testing of suitable technologies not only to solve production constraints but also to explore opportunities.

The research approach was launched in 1975 in the Ministry of Agriculture's scientific research division, housed in the newly established Economics Unit of the ministry, and headed by a CIMMYT economist and pioneer farming systems researcher, Michael Collinson. Agricultural economists were trained and employed to work in the new unit. They were initially based at headquarters, but later deployed to various stations to train the rest of the scientific research division scientists. They were directly answerable to the economist at head office, although their operations were in the stations administratively under a centre director or officer in charge. This created a parallel structure in the ministry, and in the head office, and consequently there was a negative perception from the headquarter managers, research station managers and disciplinary scientists. This negative perception as reflected a prevailing perspective that researchers already had technologies for farmers, and that they were already well aware of the constraints to agricultural production; failure to adopt improved research technologies was (it was assumed) mainly a matter of ignorance. All that was required was more teaching. The new approach was seen to be advocating a message that researchers needed to be ''*taught*'' by farmers, which in fact be a blow to the power and prestige of the specialists. This is in line with the contention of Chambers and Jiggins (1986) that

researchers often hesitate to expose their work to farmers for fear of interference or of losing control of the research agenda.

In 1983, a new economist joined the CIMMYT economics department and a re-launch was undertaken of what was then renamed as 'on farm research with a farming systems perspective' (OFR/FSP). The re-launch was preceded by two meetings with senior research and extension managers to discuss the proposed approach to research and extension services. Resolutions from these meetings included that OFR/FSP was to be an integral part of the research and extension services and that OFR teams were to be created in each research station (Matata and Wandera 1998).

Following these meetings, two in-country training sessions were held in which scientists and extension staff from different regions were trained on theoretical and practical aspects of the approach. The training was followed by diagnostic surveys and on-farm trials in participant locations; at the end of the sequence of trials, analysis and interpretation was undertaken at a central place with all participants. These activities - from launch to trials - were financed by CIMMYT with an agreement that the SRD would finance in-country training after 1987.

The OFR teams were established, but just as had happened earlier at the ministry level, funds were not provided for implementation of on-farm planned activities. There was also a problem in the establishment of the teams since teams were made up of only agronomists, animal production researchers and agricultural economists, while other disciplinary specialists such as breeders and crop protectionists were excluded.

Concurrently with the re-launching of the approach, the ministry of agriculture (through the national extension programme funded by the World Bank) launched the Training and Visits (T&V) extension system. This approach, later abandoned as unsuccessful, made use of the "contact farmer", a new name for the elite "progressive farmer" of the colonial period (Bindlish et al. 1993). At around this time, the public research organisation was also reorganised and rationalised into a set of national research centres (NRCs) and regional research centres (RRCs) (GOK 1986). National research centres had the responsibility to test commodity technologies or factors of production in relation to scale of production. The RRCs had the responsibility to identify, analyze, prioritise, test and adapt broad technologies at farm level, working through multidisciplinary teams, and linking with extension services, farmers and other stakeholders (Matata and Wandera 1998). The reorganised research centres were little different from the old commodity and general investigation centres, but the political, economic and social circumstances were different.

In 1990 a national farming systems workshop was held with the top managers of research and extension. A task force was constituted to write farming systems guidelines, and these were completed in 1991, leading to the launch the same year of the Farming Systems Approach to Research, Extension and Training (FSA/RET). A

three-tier coordination system, comprising national, provincial (regional) and district levels, was introduced. The elements were a National Farming Systems Coordination Committee (NFCC), a Regional Research and Extension Advisory cCmmittee (RREAC) and a District Farming Systems Team (DFST). Research centre staffs were made members of each DFST in their mandate districts.

The DFSTs were to coordinate joint research extension activities, in addition to preparing reports and feedback to relevant organs of the research and extensions services and exercising a monitoring role. Members included a crop scientist, livestock scientist and equivalents from extension. The whole team was technically supposed to be involved in all stages of the research process from diagnosis to implementation, and wider dissemination. This was not realised, however, due to logistical considerations, and farming systems research activities soon became an activity for the agricultural economist (socio-economist) in each of the centres. This researcher became a service provider to the disciplinary teams. These services were only intermittently sought, mainly at diagnosis or during economic analysis of completed experiments, but only rarely in the course of implementation.

It is worthwhile to note that most of the funding for the above mentioned activities was being provided by CIMMYT, whose mandate is maize and wheat research. This resulted in a focus on maize production constraints, and tended to exclude other commodities of priority to farmers. This maize commodity focus left little room for other commodities, and these received little more than a mere mention in diagnosis reports. The development plans to guide the research process, as mentioned above, could not be adhered due to the mandate of the championing organisation, and the fact that government did not play a proactive role through, for example, allocation of funds to support a broader spread of research initiatives.

The informal and formal research procedures were found to be time consuming, and largely based on extractive methods of data gathering. As a result, rapid rural appraisal methods (RRA) were introduced (Cornwall 1994). These tools were first introduced into the soil and water conservation branch of the MOA in 1991 through a SIDA (Swedish aid) funded project and some KARI scientists were trained by various donor projects (Thompson 1995). The RRA tools were introduced into the SIDA project primarily as information collection tools, rather than as an approach to involve local people in the research or extension.

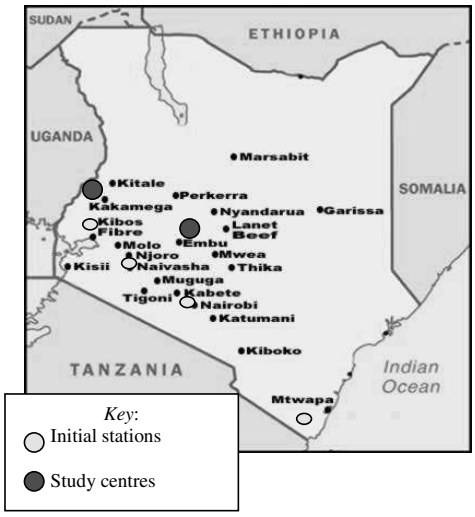
Following the introduction of new diagnostic tools, other participatory methodologies (see Table 4) found a place in the work of various international agro-technology research organisations operating in Kenya, for example, CIP, ICRISAT and IRLI. Each of these activities tended to have its own conceptual and institutional underpinnings in mandate of the organisation concerned. But most if not all of these agencies used diagnostic RRAs as a starting point, leading to further more specific prioritisation, planning and implementation. Two research projects that further entrenched participatory approaches in KARI were funded by DFID (UK) and the DGIS/KIT (Netherlands) between 1992 and 1996. In effect, the infrastructure for a

shift to participation was already being laid, ahead of any deliberate policy at government or ministry level.

Strengthening regional research programmes

In an effort to strengthen regional research, projects were launched in eight research centres. The Dutch funded KIT project operated in Mtwapa, Kakamega, Katumani, Perkerra and the UK-funded DFID project operated in Embu, Kitale, Kisii and Muguga (Figure 1). The Netherlands and UK governments committed US$350,000 yearly for five years, and within the same period the World Bank provided US$166,700 to each of four other research centres annually, with the aim of mainstreaming participatory research approaches, starting with regional research.

Figure 1: Current research centres, the study centres and the original four stations



(Source: KARI reports)

The projects started with joint RRAs in center mandate areas, involving extension and research staff, farmers and other stakeholders. These workshops were followed by joint research projects implemented with farmers. Some research activities started during this period later became the projects studied in the current research.

It is worth noting that research scientists in a particular centre might be involved in several different participatory activities hosted by different organisations, each with its own funding arrangement, agenda and conceptual underpinnings. Pull in different directions resulted and left the research managers, in particular, in a state of confusion, with a consequent tendency to lose control over what they were supposed to be managing.

4. Discussion

Controversies and misconceptions

The episodes in the extracts from explorer diaries narrated at the beginning of this chapter have a metaphorical relationship with the subject of this study. To start with 'Kenia', as spelt by Krapf, is a mis-rendering of the name 'Kirinyaga', the local name for the snow capped mountain so exciting the German missionary. The name translates (informatively) as the 'mountain with white spots'. In relation to the issues addressed in this thesis, and with all due respect to the explorers, this might be compared to the "scientisation" of farmer knowledge and innovations, and subsequent miscommunication, owing to lack of formal documentation by farmers. This consigns valid local information to a limbo of vaguely misunderstood half truth in the eyes of researchers. Krapf staked his reputation that the source of the Nile was not far from Mt Kenya and also that there was real snow, and for his pains was ridiculed by the armchair geographers of Victorian London. But as this thesis argues, further mutual exchange may clarify what was at first only glimpsed and mispronounced, and the two actors may eventually achieve an appropriate blend of effective knowledge, as will be seen later.

Controversies and belittling of so- called "lay" views are examples where the downplaying of local knowledge may seem inconsequential. The scene is often replayed in the agricultural research world and other circles. Why does it happen? It can often be attributed to vested interests or a failure to view other actors' opinion with an open mind. Take, for example, the assumptions made by the White settlers about supposedly 'unoccupied' land. This was the beginning of an entire series of other misconceptions about land, environment and agriculture characterising the entire colonial period. The settlers' concept and viewpoint of unoccupied land was different from that of the locals who practiced shifting cultivation and made use of communal grazing. In such systems, large areas left to rejuvenate would appear misleadingly vacant and hence unutilised. The settlers had their own predetermined goal, to establish homes in this new land. The agreements made between them and "community spokespersons" bordered on tokenistic, and the technical jargon used in, for example, the 1902 ordinance placed a veneer of legitimacy over what was in effect theft of land. As far as the locals were concerned, the land belonged to them, but had been loaned to the settlers, as happens repeatedly in communal land tenure systems, where no individual member of the community has a right to alienate land. The elders were trustees, and community members had usufruct rights to communal land (Kanyinga 2000). In purchasing land from one individual claiming to be a spokesperson for the clan the settlers were defying community norms. Such spokespersons were the precursors of an entire class of rural Kenyan elites who continue to milk development projects for personal advantage in the name of participation, with "innocent" project implementing agencies assuming all is on course (Platteau 2004, Kiptot 2007).

Communities then found that they were to be forcibly evacuated from communal land, to pave way for settlers, and were only allowed back as "resident labour"' or

squatters on settler farms (Hebinck 1990). This miscommunication, forced evacuation and labour exploitation later led to tensions resulting in insurgency in the 1950s. These tensions were not only aimed at the colonial regime, but at the opportunistic elites seen to have sold out their communities. The infrastructure of attitudes associated with these deep local divisions survives to this day, and bedevils all kinds of agro-technical initiatives in rural areas, not excluding "rural participation". This is why the critiques of participation, concerning the failure to address issues of power and justice, covered in Chapter 1, require to be taken seriously.

Misconceptions on land productivity

The other false assumption made by the settler regime was that lush vegetation signified high potential land productivity.. While the soils were indeed often quite fertile, other environmental factors such as pests and diseases were hostile to the exotic crops and livestock breeds the settlers brought from their homes; as a result their agricultural skills were often overwhelmed by a new damage dimension. This was a great disappointment to the settlers. Ways to cope with the pests and diseases had to be found through the establishment of the department of agriculture, and later on through institutes to train some of the novice settlers in agricultural techniques. The department, however, could not cope with the diversity of Kenyan agro-ecologies, and had to rely on farmer experience, as settlers engaged in trial and error.

This was appropriate to the needs of the settler community, but it meant that other institutional support also had to be put in place. This was in the form of subsidies, tariff protection and market supports, to keep African traders at bay, so that a "a dead weight if not a parasitic and harmful element" (Emmanuel 1972, cited in Wasserman 1974) was being supported by the government. Barriers to growing of cash crops and marketing of African crop and livestock produce, not to mention buffer zones to keep local livestock from infecting exotic European cattle, were among the measures adopted.

These reflected the European population's negative assessment of the local population – attitudes that metamorphosed into a more general institutional distrust of peasants perpetuated by African staff moving into positions formerly occupied by Europeans, the rural backgrounds of many of these civil servants notwithstanding. Institutional expectations, such as the expected hectarage of improved crop varieties and other set targets, still have a great influence on how technical staff regard local knowledge and practice. These targets live on, because independent governments in Kenya have the same or similar needs for income as the colonial government they replaced. Export crops yield tax revenue; subsistence peasant production is much harder to tax.

Research conducted according to such mindsets is likely to lean on the side of the targets set, and hence seem completely to ignore local practices since as far as the researchers are concerned, the way to meet targets is through recommendations. A belief in academically acquired skills gives the researchers a confidence similar to that of the settlers, but as shown by the many disappointing low adoptions, a

different kind of skill is required to deal with the socio-economic and cultural ecologies found in Kenyan rural areas. Local efforts that farmers make to generate technical innovations within existing social context provide an alternative set of starting points for agro-technical strategy.

The white settlers assumed there was abundant labour in rural Kenya, but this ignored the social circumstances of the African population. The labour assumed to be abundant was needed for other local purposes, and had to be forced on to settler farms through a series of ruses, including being made to pay taxes in kind. By inducing people to work to pay tax bills, three goals were achieved - provision of cheap labour, a tax revenue for government activity, and minimisation of labour competition with small-scale African producers who were not allowed to grow cash crops until much later and even then in areas far removed from the settler farms. (Wasserman 1974). It was need for experimentation by the ministry that led in the 1930s to ''elite''Africans residing in areas like Kisii, Meru and Embu, far from the white settler plantations, being allowed to engage in coffee and other cash crop production . While the tax innovation seemed to have worked for European farmers, it had social implications on African communities, since it led to an urge to engage in cash crop production which added to local discontent among the land-hungry, and later a backlash against the Europeans in the colony. Community pressures were intensified by the recommendations of the Royal Commission on land, which upheld the growing of cash crops by Africans as well as expansion of extension services to the reserves.

As will be shown later, miscommunication in research has led to a tension between the researchers, extension staff and the farmers, with each group accusing the other of not living up to the expectation of the technologies. Since the farmers are the end users of the technologies, they end up embracing whatever they can afford from whichever source, and in the process farmer innovations (both technical and social in nature) have resulted from farmer-organised innovation activity. Researchers do not seem to recognise these technical and social innovations since they have their own preconceived goals, just like the settlers who failed to recognise that clan elders had been entrusted with the land.

The above assumptions still continue to influence scientists, even when they move to do their research at an on-farm level. It is assumed, for example, that farmers will be automatically receptive of certified seeds, yet, as Hebinck (2001) argues, the institutional environment for such certified seeds has to be secure, and when these conditions are not met (when seed distribution collapses, for example) farmers distance themselves from dangerous innovations, and revert to tried and tested local ways (Van der Ploeg 1998)

Changing relationship between farmer and researchers

The colonial period has been shown to be one characterised by mutually effective interaction between staff and settler farmers. This helped to adapt technologies,

generate innovations and joint knowledge construction.. Farmer experimentation resulted in important innovation. Evidence of such farmer innovations include the rust-resistant wheat bred by Lord Delamere and the full reports of successful farmer experiments, which were rewarded with twice the amount of seed, used (Director of Agric 1908, Brown 1968). Another example of the mutual effective relation was the collaboration between the agricultural department and livestock keepers in order to *'learn the geographical distribution of the tick borne diseases*'. Much farmer-researcher sharing also occurred through commodity specialists based fora made of farmers who gathered occasionally to hold discussions on their experiences, challenges and expectations from the department.

The support provided by the government was also important, in conditions in which a close working relationship between the settlers and administrators was conducive to productive farming. By contrast, the post Swynnerton expansion into the African reserves was marked by lack of mutuality between African farmers and the extension and research staff. Mutuality was evident only in the interaction between the staff and "progressive" African farmers, starting in the 1930s with expansion of cash crops to some far flung African areas. While negative perceptions held by the staff were already existent, political events just before the launch of the Swynnerton plan cannot be ruled out as a catalyst to even greater subsequent acrimony between White and Black populations. The extension and research staff were mainly European, and some had been mobilised into an anti-M*au-Mau* police force to suppress the uprising. Research and extension services must have been influenced by the events of this period. The point here is that the Swynnerton plan may have assumed that the proposed acceleration plans would work as envisaged, but it ignored the context in which the transformation was to take place. The conditions were comparable with the launch of participatory research during a period of single party rule in Kenya with little tolerance for dissenting views. Then as more recently, in the eyes of farmers the research and extension embody the power of a distrusted regime. As contained in various documents (see for example Swynnerton 1957 and 1962), the successful cases cited to illustrate the workability of the plans concerned "progressive" farmers, who were beneficiaries of production inputs provided as rewards for proper farm plans. Yet, these were often members of a collaborationist class earlier opportunistically selling African land to settler farmers. The pilots worked flawlessly, but replicability was low. Any collaboration between the African farmers and the European staff members as envisaged in the Swynnerton plan foundered on bitter memories of betrayal.

In effect, the progressive farmer approach was vitiated by its emphasis on a group deemed to be loyal to the government. As reported by Conelley (1998) some Kikuyu migrant workers in the 1920s had already purchased exotic grade animals from European farms in contravention of the Cattle By-Laws, with these cattle being crossed with local Zebu to produce what agricultural officials saw as semi-grades, because Europeans only sold poor quality animals to their workers. Hybridity (even among cattle) was suspect in a colony in which reliability was measured by the regime in skin colour. These kinds of adaptive innovations were simply ignored

when the government spearheaded its pre-independence plan for the development of African agriculture. At independence, the government changed, but it still needed loyal elites in the countryside. The official approach continued. Commitment to standardised agricultural approaches remained a measure and indicator of loyalty even after the racial divide disappeared.

Shift of clientele, change of approach: emergence of duality

The situation described for the settler farmers was different for the small-scale African farmer whose agricultural interests were initially not considered as warranting any research or extension service. Indeed, there was an apparent and deliberate negative opinion on the importance of the agricultural production in the rural reserves occupied by the African farmers together with their farming methods. The European farmers had a monopoly of the most profitable crops especially coffee which the Africans were prevented from growing on a significant scale until the 1950s (Leys 1975). Such tendencies extended to manipulation of internal markets through protective tariffs and legislation to fix local market prices through for example the 'Native Ordinance Act' of 1935 being examples of expressions of this opinion. Settler farmers' products fetched a premium price for their product while rejection of produce or low prices were offered for local produce because of their perceived inferior quality. An example was locally produced maize which was multi colored and of hard texture which was viewed as a contaminant to the white and soft textured maize varieties as well as undesirable for improved agricultural practices (Hosikinson, 1994, Jayne et al. 2002). Such practices and legislation reflected and reinforced the negative perceptions thus leading to a negative attitude towards local crops and practices and the farmers. Partial existence of the negative attitude is evident to date and evidenced by labelling of locally generated innovations as 'indigenous technical knowledge' (ITK), 'farmers or local practice' and are grouped together with others and pejoratively labelled 'jua kali''. Another case illustrating the negative attitude towards the small-scale farmers technology is found in the area of breeding and seed provision where breeding programmes until recently acquired most of their germplasm from International Agricultural Research Centres in total disregard for local germplasm. Hence local varieties with good culinary and processing qualities are often disregarded and high yielding improved varieties promoted. Farmers however have continued with their local varieties while the seed sector invests heavily in providing ''superior certified quality'' (see Chapter 1 and 5)

Other indicators of the negative perception about African farming system are easily found in various documents like the consistent reference to '' the scattered plots or 'shambas' (see Swynnerton plan) that represent an 'un-economically viable production system(Swynnerton plan 1954). According to the recommendations in the Swynnerton plan, this issue of underdevelopment had to be addressed through land consolidation and registration followed by training and guided cultivation to change the 'subsistence native agriculture to a level that could be economically viable (ibid). This is the perception that agricultural and research staff posted to work in the African areas associated with the local agricultural practice. The shift of focus of the

research system in 1954 after the Swynnerton plan marked a discontinuity that shifted focus from the relatively uniform areas of the settler farmers to the more marginal and variable areas with small-scale farmers. The shift overlooked the complexity of the age-old African farmer's practices and systems, which had spatial heterogeneity and temporal variability relative to the homogeneity of settler farming. The many pieces had various uses and hence covered several niches accommodating the wide diversity of crops grown. Each of these pieces was managed differently similar to what Richards (1994) reports about rice farmers and catena cultivation in Sierra Leone. This management of variation is for small-scale farmers a way of coping with uncertainty and risk (Almekinders, Fresco and Struik 1995).

The negative attitude towards local practices led to a situation in which agricultural staff was not open to creating mutual working relations with the farmers in the areas on which the attention was now focused. Instead, demonstrations of improved practices were conducted with a few chosen 'exemplary or progressive small-scale farmers with the intention of changing the perceived 'primitive' African agriculture to modern agriculture. These exemplary or 'elite' farmers as described in Chapter 2 were those perceived to be loyal to the colonial government and were often chiefs and other serving government servants. They all partly shared the attitude of the colonial staff and hence were separated from the rest of the farmers who referred to them as 'Agriculture farmers' or *watu wa mission*, as compared to *'watu wa blanketi'*. New crops like maize or cabbages demonstrated in the plots became *agriculture maize or cabbage* and these labels exist to date. The ''agriculture crops'' and their management practices contained in 'standard recommendations' as practiced in the demonstrations plots were to be unquestioningly applied in the farms. This situation and perception continued into the post-colonial period and at times coercion through fines was used to enforce adoption. However, the majority of the so perceived laggard farmers continued practicing their subsistence farming and where suitable, they adapted the technologies to their environments and needs in the newly consolidated forms.

Crop management practices and mandate orientation

Some of the crop management practices developed during the colonial period are still in use up to the present period. This includes crop spacing recommendations, despite changed conditions on African farms. In some cases, the unit of measurement has been changed, for example from yards to metres but in practice everything remains the same. The modification due to intercropping made by the farmers, as shown by Mose et al. (2000), even in a commercial maize region, are often taken to be a farmer practice and thus assumed to be ''a non-experimental variable''. This has serious consequences on trial results developed in pure stand circumstances but applied in intercropped conditions. Other cases include recommendations on farmer animal breeds. This is also partly tied to the mandate approach to research. Research in the colonial and postcolonial periods followed a specific mandate approach that did not accommodate other commodities. A researcher on beans could only deal with beans. This tendency has continued, with the problem being made worse by

weaknesses in the extension service. In such a situation it is unlikely that feedback into research will be acted upon.

Increasing Donor dependence

In this chapter, we have seen how the 1977 reorganisation of regional politics affected the organisation of the research institution. It is an illustration of the inter-dependence of the research system with context. This fits the notion of discontinuity, in which the organisation adapts too readily to change in the operational context. Such changes took place immediately following changes the ministry had earlier resisted. These changes led to the emergence of the present network of KARI centres, each with its own history, important in the analysis of current functioning. Funding of the research operations up to 1969 came from the government, but this increasingly shifted to donor funding, and inputs from international agricultural research centres regional programmes also figuring prominently. These actors then gradually transferred their own agenda into KARI, limiting room for KARI's own agenda.

This resulted in a contradictory situation in which calls for farmer involvement in research were embraced by the organisation through farming systems research, but the extension service, working with the same farmers, continued with the transfer of messages through contact farmers. The situation did not change, even when the group extension approach was adopted, since the groups just served as "contact" points for the community. Since groups were dominated by rural elites the problem of internal suspicion was not abated (Kiptot 2007). Planning, implementation and evaluation have not changed, despite changed donor conditions. As reported by Connelley (1998) and Castro (1998), who document livestock and cotton development initiatives in Kenya, development planners often suffer from selective amnesia where mistakes occur, and assumptions continue, even where there is overwhelming evidence from the past of the need to change.

An inventory of key events and changes in Kenya's agricultural research is summarised in Table 2 below.

5. Conclusion

As illustrated above, agricultural research and development in Kenya has had an intertwined existence. In the course of expeditions to explore the source of the Nile and sample snow at the equator, the fertile and seemingly idle wildlife-laden land of interior Kenya began to attract attention. Explorers and missionaries played a significant role in events later leading to the emergence of a research system in the country. The missionaries evangelised and tutored the local population in writing and reading skills, and these proved to be first steps towards Westernisation, and a

Table 2: Events and phases of agricultural development in Kenya

Agricultural phase	Events	Remarks
1890s-1902	Early settlers, Kenya-Uganda railway	Relocation of locals and an economic development goal
1903-1913	Agriculture department and research stations established labour to settler farms	Relocations, forced conscriptions and local political awareness
1914-1924	War years and more stations	Forced conscription and relocations
1924-1940s	Restricted cash cropping by locals and testing sites	Progressive farmers and forced soil conservation -
1940-1953	Mau-Mau war and the Swynnerton Plan for reserves	Focus of R/Ext to reserves Land reforms against local wishes
1954-1963	Regional investigation stations and independence	Early indigenisation of the research staff
1963-1973	On station research and progressive farmer strategy, Rodenheiser review to SRD	Farm management and transfer of technology approach
1973-1983	FSA and T&V system of extension	Transfer of technology and progressive farmer
1984-1994	Participatory research approaches, MRST and MOU	Policy and institute goals conflict with farmer involvement and goals as well as working relations
1995-2000	Strengthening of Regional Research programmes	Training on Pax approaches and on-station/on farm research imbalance
2000-2005	Attempts to elicit demand for technologies and feedback	Launching of ATIRI initiative

first major discontinuity in local people's lifestyles, as well as a springboard for introduction of new crop and animal production technologies. The discontinuity was mainly manifest via the '*watu wa mission*' or the upcoming elite group, who became 'progressive farmers', while continuity continued with the '*watu wa blanket*', of whom it was hoped that change would come in due course. This anticipates present day research and extension applications, where a few outstanding members of the community are selected to participate in the launching of new projects. Such people become advocates of the development agents, irrespective of the feasibility of such projects. As happened in the early days described above, a certain proportion of such people take advantage of these projects and in the process become isolated from the rest of the community. The development agency often assumes that all is well, since the social dynamics in the community may not be clear to them. In any case, as often happens, the objective to launch a project will already have been achieved and the effectiveness or impact is left for another time and actor to test.

The European settler's arrival had a far reaching effect on a perception of farming that continues to dominate the Kenyan research landscape up to the present. Settler farming was a discontinuity in the region, and contrasted strongly with the predominant peasant African farming. The railway line construction also represents another discontinuity (in communication), and played a significant role in that inputs could reach farmers and as easily as produce could be delivered to its market. Farming equipment such as tractors and other heavy machinery were easily transported by rail thus relieving manual labour in the farms. Introduction of new farming methods to the African farming system was also a discontinuity, enhanced by the launching of the Swynnerton Plan, another break with the past.

However, it is also of note that despite intentions, it is apparent that the management of agricultural research and extension did not achieve the magnitude of change expected. As illustrated by the settlers' protectionist policies and influence on the colonial state, a lot of intended change efforts were thwarted through policies limiting the extent of involvement of local farmers in key areas. An example is the African representative expected to join District Agricultural committees, with such information not often being conveyed to the concerned parties (Brown 1968). This situation is also evident in local participation on Native Councils in the 1920s, where the district officer had veto powers as the chairman of these local bodies. Coincidentally, this situation has continued in many government institutions, as well as among farmer groups and organisations, where chairmen of groups citing powers bestowed on them have mismanaged their establishments in collusion with other officials.

It is noteworthy that the assumed similarity of the Kenyan highlands environment with the temperate European environment turned out not to be the case. Localised production problems had to be contended with, and hence the need was felt for an agricultural department and research system that would provide solutions. The settlers in this context encountered the reality that technologies do not have inherent characteristics that *per se* lead to high production, but performance depends on localised bio-physical and social environments. These environments have to be conducive if expected performance is to be achieved. Pests and diseases as well as labour bottlenecks threatened commercial settler production, necessitating establishment of the department of agriculture, while taxation and forced labour resolved the labour situation for the planters.

This ought to have been a lesson to the professionals and to farmers at an early stage, concerning the limitations and futility of transferring technology from one area to another in a 'cut and paste manner' simply because the physical environments seem similar and conducive. An encouraging occurrence, however, is the fact that the department of agriculture had personnel ready to learn from field practices of farmers. Consequently a wide repertoire of practical knowledge and information was amassed through the concerted efforts of these actors (Brown 1968). This is a major lesson for today's agricultural researchers. An example would be the introduction of

farming systems research as well as the many participatory research approaches on offer. As will be shown later, the shift to a fully functional participatory research is still shrouded in doubts even when the requisite structures have been put in place. Capacity has been built through training of researchers, but operationalisation of the process in the field still leaves some lingering doubts centered on factors to be explored in later chapters.

A series of continuities as well as discontinuities are evident in the course of this account of the history of agricultural research and extension in Kenya. Global as well as regional and national political events such as two World wars, the Mau Mau rebellion and the country's independence, followed by the break-up of the East African community, all had influence over the way the research system emerged. The demand for increased food in the Second World War led to the opening up of the agricultural sector to the locals, and subsequently native marketing outfits, which in turn necessitated increased attention on local farming and the training of local agricultural instructors and chiefs. The shifts ran from commodity stations only, in the period prior to the First World War, to include general investigation stations and testing and demonstration sites in the 1930s and '50s, to the current national and regional centers and dual mandates. These shifts and rationalisations have been followed by changed mandate areas aligned with political and administrative boundaries and events. While every administrative district is expected to have a research centre, this requirement has overstretched the human resources capacity of KARI, considering that what started off as a 41 district country has increased three fold to 130 districts. All these districts have to be served by the same handful of research centres, and this illustrates a conflict between science and politics. The situation becomes even more complicated when budgets provided to the research centers are not proportionately increased with increasing mandate areas. This is because some of these decisions to split administrative units are made in the middle of financial periods. The issue of staffing is also another one where decisions made by donors to retrench staff have led to bottlenecks in implementation of some research activities, as will be shown in the next chapter.

CHAPTER 3

HOW THE INSTITUTION WORKS: ETHNOGRAPHIC VIGNETTES OF KARI ACTIVITY

1. Introduction

This chapter is a technographic account of the operations of the Kenyan Agricultural Research Institute (KARI). Technography is the attempt to analyse technological practices from the point of view of ethnographic observation (Richards 2002). The chapter is an attempt to convey a flavour of KARI at work, and to ask questions about the part played by the participatory, farmer-oriented perspectives in its research activities. It starts by looking at the certain activities within daily life at head office, where the senior research managers who coordinate research programmes are housed. Thereafter, the flow of planning and implementation of programmes and projects all the way down to the work of the researcher at the farmer level is described. This unfolding of programmes and projects interacts with, and is influenced by, the interests of donors and other collaborators through managers in meetings, evaluations, reviews and consultancies, and thereby forms networks that have an influence on research practice. The results of the interaction between donors and other collaborators and senior managers become the guiding principles of research activities undertaken by the institute. These principles are then conveyed to the research centre managers through meetings, circulars, memos and other, more informal, communications. The perceptions of the different actors determine the implications of the procedures and practices for KARI research, and this determines in turn how 'science' and participation are practiced, through inscription as a technique of inclusion (and exclusion). It is observed that such factors as institute goals, mission and assessment criteria, availability and timely release of funds, as well as researchers' attitudes, impact heavily on the actual conduct of research and the direction of flow of information.

In this chapter, we elaborate on the heterogeneous networks created as different social actors and "actants" interact in the research process. We also attempt to show how and why a disconnect occurs between research plans and farmer priorities, despite the elaborate diagnosis and planning process to be further elaborated in Chapter 4. The interactions between the donors, international research centres and private sector, as mediated through head office and at the centre, end up driving the research agenda. Competing demands often contradict the prerequisite for dialogue expected in a participatory research process.

2. The organisation of the research institute

KARI currently has a research network of 22 main research centres and 14 sub-research centres covering different agroecological regions of the country (see Table 1). The 22 main centres are the former national and regional research centres. The "main research centre" nomenclature is currently a source of controversy, since all the centres implement adaptive research work, even though only nine are officially recognised as adaptive research centres (six regional and three dual mandates centres). The research centres conduct adaptive research derived from their national programmes pertaining to technologies applicable in their various localities. The line between the national and regional centres has over the years become blurred. The original provision, as indicated earlier, was for national centres to conduct basic and strategic research that would then be applied and adapted by the various regions through the regional research centres (Anadajeyesekeram et al. 1996).

Table 1: Main research centres and accompanying sub centres

Centre	*1986-2002*	*Responsibility**	*2002-present**	*S/centres*
1. Headquarters				
2. Kitale	*National*	*Maize/pastures*	*Natl/Regional*	
3. Muguga South	*National*	*Land and water*	*National*	
4. Muguga North	*National*	*Veterinary*	*National*	
5. Naivasha	*National*	*Dairy cattle*	*N*	*1*
6. Njoro	*National*	*Wheat research*	*Natl/Regional*	
7. Molo	*National*	*Pyrethrum*	*N*	
8. Tigoni	*National*	*Potato*	*N*	*1*
9. Thika	*National*	*Horticulture*	*N*	
10. Kiboko	*National*	*Rangeland res.*	*N*	
11. Mwea Tebere	*National*	*Fibre research*	*N*	
12. Kabete	*National*	*National Labs*	*N*	
13. Marsabit	*National*	*Arid lands res.*	*Natl/Regional*	
14. Katumani	*National*	*Dry land research*	*Natl/Regional*	*5*
15. Lanet	*National*	*Beef*	*N*	
16. Kibos	*National*	*Cotton*	*N*	
17. Kisii	*Regional*	*General*	*Regional*	*1*
18. Kakamega	*Regional*	*General*	*Regional*	*1*
19. Perkerra	*Regional*	*General*	*Regional*	
20. Embu	*Regional*	*General*	*Regional*	*1*
*21. Garissa****	*Regional*	*General*	*Regional*	
22. Mtwapa	*Regional*	*General*	*Regional*	*4*

* commodity mandates prevail alongside adaptive (general) mandates
* Natl/Regional – official dual mandates with budgets allocated to do adaptive work
*** In North Eastern District, submerged by El Nino floods – reconstruction underway

This explains why national centres have a national mandate for the specific commodity or programme that they have been assigned. The regional centres work on a range of issues relevant for the regions they serve. However, the presence of farmers around all of these centres has resulted in a situation in which all centres carry out a certain amount of applied and adaptive research, thus - in case of the national research centres - leading to a dual mandate.

This situation has also been compounded, and at times confounded, by research work done collaboratively with international agricultural research centres, for example CIMMYT or CIP, and other actors with components of their regional programmes in Kenya. The research centres are the sites of some of this work, and often the bulk of the work one finds in such a case is collaborative with the IARCS. There is no problem with this arrangement, but occasionally the kind of work that these IARCs conduct has only partial local relevance. On the other hand, KARI centres also derive a lot of materials from adaptive testing for such programmes. Similarly there is no problem with this arrangement, apart from the fact that the major decision maker on what is to be tested is the IARC. Such situations have occasionally led to contestation over for example the proprietary rights of jointly-tested crop varieties. It is also true that data and information collected have wider application than the area served by the research centre, and hence local needs may be subjugated to wider regional needs. All these situations end up with the research centre tending to hold the ''thin end of the stick" and hence there often tends to be a whittling down of the role of the research centres in basic and strategic research, as the IARCs take charge of the agenda. This has led to cynicism that research centres have become little more than sub-centres for the international research centres.

3. Mandate and objectives

The KARI mandate covers a diverse array of crops and livestock across the diverse Kenyan agro-ecological zones. Initially, KARI was expected to do research, with results handed over to the Ministry of Agriculture for extension to the farmers and other stakeholders. However, according to the Strategy for Revitalisation of Agriculture in Kenya (SRA 2004), discontinuation of donor financial support in the 1990s, ineffective and inappropriate methodological approaches, and a conservative attitude on the part of personnel have negatively affected the transmission of technologies to the users. This has particularly impacted negatively on the smallholder farmers who form the majority of the farming population in Kenya. According to the 2000-2010 strategic plan and mission statement of the institute (KARI 2000) KARI will seek to acquire and contribute to knowledge and creative solutions that are participatory and client oriented, holistic, system oriented, gender sensitive and affordable by stakeholders (KARI strategic plan 2000-2010).

The mission statement is operationalised through six strategic objectives as follows:

1. To develop and validate appropriate technologies and knowledge
2. To develop or enhance appropriate participatory and consultative technology development approaches and methodologies
3. To disseminate knowledge and technologies and to catalyse the process of outreach and adoption of agricultural technologies
4. To contribute to and influence the development/change of agricultural policy environment
5. To strengthen the efficiency, effectiveness and sustainability of KARI's institutional capacity
6. To establish sustainable funding initiatives

In this operationalisation, the institute works closely with relevant government ministries and the National Council for Science and Technology (NCST), cooperates with both local and international institutions of higher and tertiary learning in training programmes, and collaborate with international and national agricultural research bodies.

Management and capacity

KARI is governed by a board of management which comprises 14 members, with the director being the secretary to the board. Six members are appointed on the basis of their areas of specialisation in different fields while the other seven members are representatives of relevant line ministries. This board has a technical and a finance committee. The technical committee overseas the technical aspects of the research programmes while the finance committee deals with research programmes financing and other institute financial needs. The board is expected to meet four times a year, following the meetings of the two committees.

The director of KARI is the chief executive of the institute, assisted by two deputy-directors, and eleven assistant directors, the same number of programme officers and four chiefs of divisions in charge of accounts, supplies and personnel administration.

Some research project coordinators are supposed to work closely with the assistant directors and programme officers but their role spans across research centres, hence contestation arises due to position in the hierarchy. Consequently, this has created tension with the assistant-directors and the centre-directors, since project coordinators are based in the research centres, but their responsibilities span across centres - for example, there is a maize coordinator for six research centres. Administratively speaking, a centre director is answerable to the project coordinator in his/her centre as far as research work in that project is concerned. On the other hand a project coordinator based in a centre is directly answerable to the centre director for regular administrative issues. This position should however not be confused with a project or programme leader in a centre who coordinates other scientists in a centre working in that particular project of programme and is answerable to his/her programme assistant director at the headquarters through

his/her centre director (Figure 1). There is thus some scope for confusion about who commands whom over what. KARI – it should be noted – is not a pure hierarchy. This is in part a result of its complex origins, as outlined in the previous chapter.

Figure 1: An organogram of KARI technical and administrative organisation

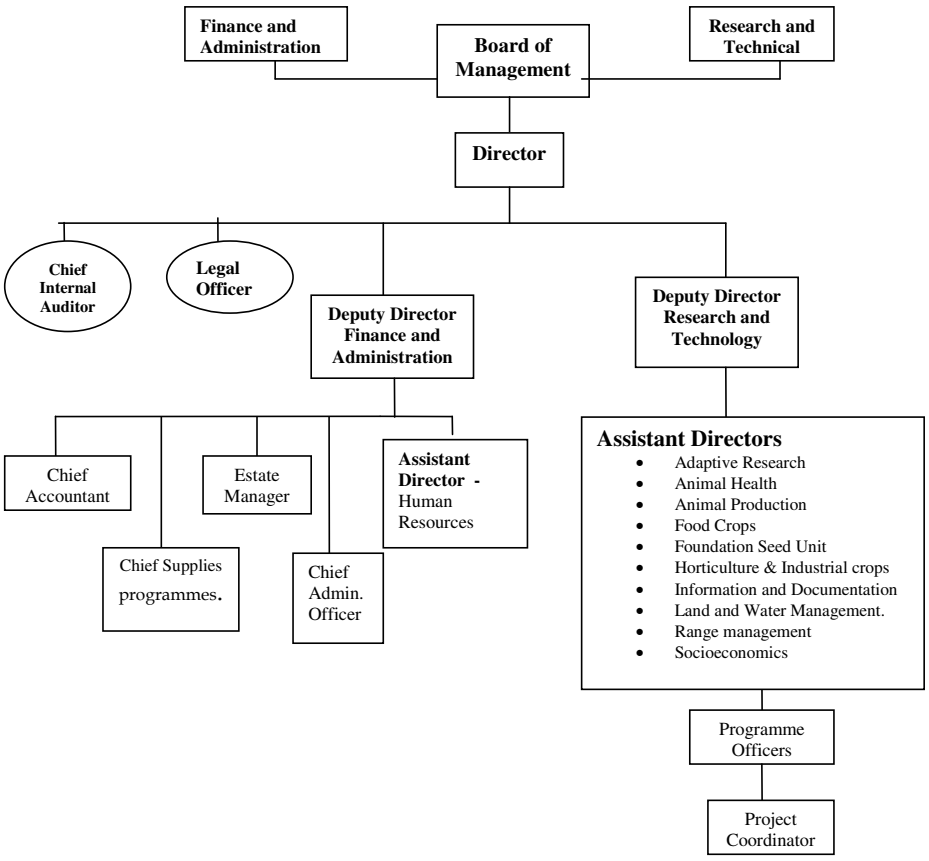


Table 2 shows the human resource capacity in KARI, as applicable during the period of study. The support staff numbers have been drastically reduced through World Bank recommendations in line with the Kenyan structural adjustment programme (SAPS). In some cases this has affected the performance of the normal duties of the centres, leading to a cut back on research activities and buying in of services formerly provided by full time staff. Drivers are a case in point, where some research centres have vehicles with no drivers. This has in turn necessitated deployment of support staff as drivers or in other roles, in turn hampering performances other activities.

Table 2: Human resource capacity

Category	2000/2001	2001/2002	2002/2003
Research Scientists	475	525	518
Technical staff	1005	980	949
Support staff	2010	1896	1808

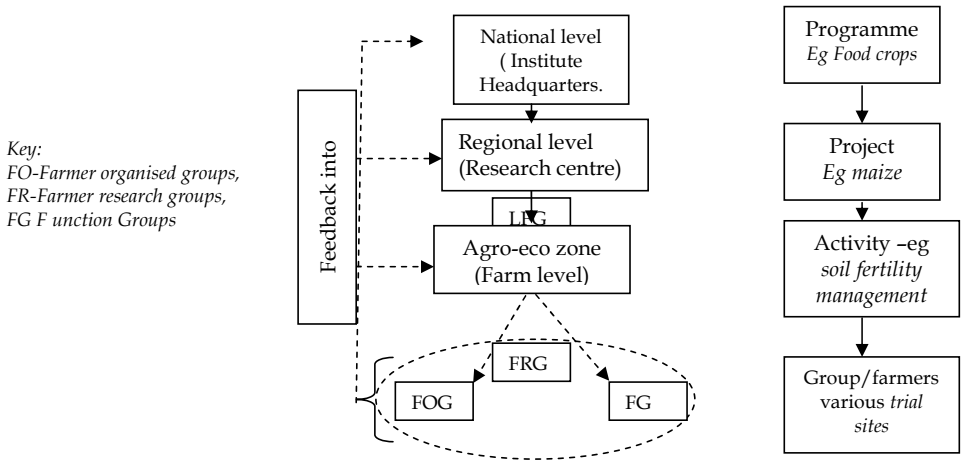
(Sourc:: KARI Third Medium Term plan)

4. Research programmes and projects

Programmes

For the period of this study (2003-2005), KARI was financing the implementation of its programmes through funds provided by the World Bank and other financiers, via the National Agricultural Research Project (NARP) phase two. Research programmes which are defined as thematic groupings of related commodities or production factors. The related commodities or commodity then form projects which are implemented in various research activities at zonal level at farm level or in the research centres. Many research activities are implemented with farmer groups at farmer group level, and as will be shown in Chapters 5 and 6, many more activities take place at the farmer level Hence, KARI has programmes such as food crops, horticulture and industrial crops, land and water management, animal production, animal health, range, socio-economics and regional or adaptive research

Figure 2: Various research organisational levels in KARI



Within these programmes, various projects are embedded. In Figure 2, an example is shown where the food crops programme has a maize project in which there is a research activity on soil fertility management conducted in several sites with farmer groups

Research technologies developed in the strategic and applied research phases of various programmes are subsequently adapted to various agro ecological zones in the adaptive research programme. The adaptive research programme also has the role of testing various methodologies including participatory research methodologies and approaches to be used in the adaptive testing of these technologies with the farmers and other stakeholders . The programme also has an additional role to coordinate an outreach component aimed at creating awareness on existing technologies among farmers and other users. This is with a view to catalyse an out-scaling process. The researchers who conduct these adaptive activities are the same ones who are involved in the strategic and applied research phases of the various programmes and projects which could be said to be their professional bedrock. As will be shown in Chapter 4, this has a bearing on the implementation of the adaptive research projects as technologies reach the adaptive testing phase.

In certain cases, confusion results from reference to projects as programmes or vice versa. An example is the maize project which is often referred to as programme when the various maize production mega-environments are considered. Hence, the lowland maize programme or highland maize programme. In this thesis and for administrative purposes at KARI such 'programmes' are referred to as projects within broader KARI programmes.

Projects, research activities and outputs in research centres

As mentioned above, under the broad umbrella of programmes (such as food crops), KARI has projects grouped into broad families such as cereals (maize, sorghum etc), root and tuber crops (cassava, sweet potato etc), legumes (beans, peas etc), floriculture, dairy, and so on (see Figure 2) and these are of necessity located in research centre. The different commodity and factor families constitute projects, and within each project are the research activities that are expected to result in outputs.

To operationalise research projects, research activities or protocols are implemented through which expected outputs are achieved. These are the research experiments or trials. Typically, they involve testing of various production factors, types of crop varieties and animal breeds.

In principle all research activities within a programme or project are expected to fall into the described scheme (Table 3). There is, for example, a testing programme for different tillage practices for maize which gives information on appropriate herbicide use in minimum tillage applications. This activity falls under the maize project in the food crops programme. It may on occasion be referred to as a weed management project, thus confounding 'project' with 'activity'.

Similar confusion may also arise in the cases of production factor projects on commodity crops. An example is the land and water management fertility project that uses maize as a test crop, which may therefore be mistaken for a project of the food crops programme. Confusion may also arise out of reference to donor or collaborative projects as 'programmes'. These are often collaborative projects that may be global or regional or even national in nature and comprise several components that go beyond the outlined programmes of the institute. In short, they do not fit the institute scheme as shown in Table 3.

Another possible source of confusion may be from specially funded projects that fit into the mainstream KARI programmes but where the institute has little room for manoeuvre, meaning that the originating agency decides everything that is supposed to happen in the project.

Table 3: Donor and KARI projects and programmes

KARI Programme	***KARI Project***	***Research activities /protocols***	***Donors (source of funds)***
1. *Food crops programme*	Cereals – *maize etc* Legumes – *beans, and others* Root/tubers – *cassava, potatoes*	Variety development and management strategies such as weed management	*National Agricultural Research Project 2 (NARP2) (World Bank)*
2. *Land/water management programme.*	Land use, soil fertility, irrigation and drainage	*Natural resource management*	*ASAL project (EU)*
3. *Horticultural/industrial crops*	Flowers, vegetable, oil crops, spices	*Variety development and management*	*Bilateral donors*
4. *Regional Research or adaptive research programme*	Adaptive research projects and joint activities	Adaptive testing of generated technologies and participatory methodologies and feedback	*IARCs*
5. *Animal production programme*	Dairy, beef, small ruminants, pigs, pasture/fodder range management	Breed development and management practices	*Private firms*
6. *Animal health programme*	Livestock diseases	*Health management practices*	
7. *Range research programme*	Rangeland research	*Rangeland resources management*	
8. *Socio-economics research programme*	Priority setting, M&E, Marketing and policy	*Socio-economic aspects of research*	
9. *KARI seed unit*	*Basic and pre-basic seed*	*Seed production and management*	

10. Information and documentation	Library, documentation, IT, publications, information packaging	*Information packaging and documentation*
11. Agricultural research investment (ARIS)	*Research commercialisation*	*Commercial production units*
12. Biotechnology	Livestock vaccines, crop development	*Testing of vaccine kits and biotech products*

Table 4: Specially funded projects

Project	Donor	Focus
Western Kenya Ecosystem	GEF/WorldBank	NRM and community empowerment
Sustainable soil management	GEF/World Bank	NRM
Kenya ASAL research	EU/GOK	Livestock research livelihoods
Soil management	Rockefeller	Biological processes for soil fertility
Biotechnology	USAID	Crop ,livestock vaccines and GGB
Desert margins programme	GEF	Alternative livelihoods
Insect resistance maize for Africa (IRMA)	CIMMYT/Syngenta	Stem borer resistance (GMO)
Coordinated ecosystem breeding	Rockefeller	Maize streak virus, striga, smut, grey leaf spot
Contracted research	Seed and ag/chemical firms , comodty groups	Variety testing, pesticides and commodity specific research eg Horticulture

Source: KARI Third Medium Term plan

The specially funded projects fall under specific programmes but coordinators are appointed to head them. Hence the soil management project under Rockefeller funding technically falls under the land and water management programme. However the funds and administration of this project are outside the institute mainstream funding procedures, even if implementation at centre level is by same scientists who implement other institute projects.

The purpose of going into details about this categorisation is to clear up possible confusion that may occur in reference to any particular nomenclature in this thesis, but also to show the effect of donors and their strong influence on the institute's research programmes. Even though the special projects are implemented with full awareness of the head office, they are usually under the management of specific research centres. Donors and other actors in those projects sign a memorandum which allows them to work directly with research centres.

5. Interactions at KARI head office

KARI's head office is located on Kaptagat road, west of Nairobi city, on a 14-acre farm. As you enter the head-office compound, you are guided by security guards who open the blue gate. Behind the gates are the offices, consisting of a three-floor

high administration block, a conference hall and a cafeteria, a warehouse, a petrol station, and a scenic landscape. The warehouse and petrol station are recent additions to the headquarters facility, within whose vicinity is the parking yard for the fleet of KARI Nairobi-based vehicles in their navy blue and white branding.

The ground-floor and part of the first floor of the administrative block are occupied by the administrative and support-staff dealing with personnel affairs, accounts, supplies, transport and maintenance. It is in these offices that a lot of the decisions made on the upper floors of the institute are implemented. Hence action decisions on staff transfers, financial disbursements, procurements or equipment maintenance are operationalised by the staff accommodated here.

The assistant-director in charge of Information and Documentation Services occupies an office on the second floor, together with personnel manning the three main units under this service. These are the publications and documentation services, library and information technology unit. The library, strategically located immediately on the left as you climb the stairs, is the depository of all published institute documents as well as external items from all over the world related to agricultural research. It has both internal and external databases, in what is called the Kenya Agricultural Research Database (KARD). Through this library the institute also links with other libraries internationally, and while a lot can be achieved through this link, the infrastructure available limits the level of library service provision. An example is the weak interconnectivity within the Local Area Network (LAN), that prevents on-line servicing of requests, requiring the researcher physically to pay a visit to the library and print out any necessary material from the several volumes of compact discs from AGORA, CABI and other available databases. The library also coordinates the operations of the other research centre libraries in the country.

The publications unit is responsible for institute publications and documentation. This mostly involves publication of annual reports, institute documents such as the strategic plans and others. Owing to limited equipment and capacity, this work is coordinated by the unit and the printing and publishing takes place through out-sourcing. The IT unit overseas the functionality of the information technology hardware and software and plays an important role in keeping the institute in virtual connection to the outside world. Maintenance and debugging of the many computers and software systems is a main chore of the wizards in this unit.

Three other assistant directors (ADs) and their programme officers are also housed on this floor. These are the AD in charge of adaptive research, AD for human resources and the AD in charge of the agricultural research fund. The third (uppermost) floor is occupied by eight other assistant directors and their programme officers, two deputy directors and the institute director, whose eastern wing office adjoins the board of the KARI chairman's office. On the same floor, there is a boardroom with capacity for 40 participants. This is usually the venue for senior management meetings, seminars or any other meetings involving more than twenty people. This is supplemented by another smaller room with a capacity for 10

persons. The room is commonly referred to as '307'. In these two board rooms the strategies of the institute are formulated and major decisions made.

The conference hall with a capacity of 200-persons and a big and small adjoining seminar rooms are handy facilities during the biennial KARI conference and other large gatherings organised by the institute. The facilities are also used by other organisations for a fee.

The institute director

Chapter 24, section 4 (b and c) of the 1969 organisation book of the ministry of agriculture, states that:

> *The head of the Scientific Research Division (SRD) of the Ministry is to advise the agricultural research council and government on science and technology advances likely to be important in national development and also maintain a high standard of [agricultural] research in all research institutions.* (MOA organisation book 1969)

The title of the head of the research division in 1969 was 'Chief Research Officer' (CRO). The designation was later changed to Director of Research. He is the chief executive of the institute (all directors so far have been male, so for convenience I will continue to use this version of the pronoun in the following account). His terms of reference are divided into two and include (1) international and national external collaboration and contact as well as (2) the internal coordination of the operations of the institute. Policy matters such as liaison with the central government, board of management and other national and international partners fall also under the rubric of external collaboration. This also involves dealing with financial matters. The Director has to defend budgets for KARI operations treasury (Ministry of Planning and Finance), aid donors and other funders of research operations. On internal matters the director is expected to provide leadership to the institute management team in terms of interpretation and operationalisation of the mandate given it by the government, and to maintain the institute's vision and mission.

He implements these requirements through meetings that he holds with the staff, both at head office and in the centres. In these meetings he makes reference to various aspects of KARI business in relation to its mandate and mission. An example, in relation to objectives, is as follows:

> *As we implement this new project it is important to remember our mission and strategic objectives. Strategic objective number three and four are very important particularly in relation to this project. As our colleague from the ministry has mentioned... we have to step up our performance in order to meet these objectives. At the end of the day remember that the farmer needs to put food on the table and money in his pocket. This is possible through the many technologies that we have developed...* (Notes on staff meeting 2003)

Another way of reminding staff of the strategic objective is through the documents the director writes. Two extracts from such a document convey a sense of the typical language:

> *In the various tasks we must always remind ourselves of KARI's mission, vision and objectives. As an institution of excellence in agricultural research and development, we must always underpin KARI's objective and contribution to the national goals.* (KARI director 's paper 2004)

> *Production of various vaccines has increased threefold and we are supplying key vaccines not only locally but to Uganda as well. We have entered a distribution arrangement with Coopers Kenya and Coopers Uganda and soon we shall partner with Biogenesis of Argentina...increasing revenue generation considerably* (ibid.).

These references to strategic objectives, missions and mandates, together with national goals, are aimed at ensuring that staff are regularly reminded of where their efforts are expected to be directed. At the same time it shows that the director outlines the 'contours' of an operationalisation of mandates and vision, but that the actual filling in is left largely to the deputy and assistant directors as programme leaders and the staff within their respective programmes at the centres. The language at the top is exhortatory but rather general in tone.

Another role the director plays is that he exercises ultimate authority in all operations. This means that while he has delegated powers to his deputy directors and assistant directors, he is ultimately responsible for all their operations. As an indicator of this, all official letters from the institute are signed by him, or on his behalf. His signature is a symbolic representation of where ultimate power in the institute lies. To ensure that institute policies are also clear to those who work in the 22 research centres, the director occasionally invites centre directors to the headquarters for briefing. In such meetings, centre directors have a chance to clarify certain policy issues. They are then expected to pass on these policies to their staff once they are back in their respective centres. Assistant directors and chiefs of division are normally in attendance in such meetings.

The most regular updating occurs via institute circulars and briefs. These are sent to the research centres to update them on issues affecting institute business. Circulars, briefs and any other communication are often transmitted to and from the centres through or by the two deputy directors, who represent the director and regularly visit the various research centres. KARI is thus, in terms of personnel a regular hierarchy, with a single head, and a number of deputies with clearly defined functions. But as noted above, this hierarchical ordering is not so clearly reproduced in terms of programmes and projects, due to the rather ad hoc influence of external partners.

Deputy director, research and technology

The deputy director in charge of research and technology directs research in the institute, as his title suggests. He is in charge of the administration of technical matters regarding research, and this starts with research priority setting, planning and implementation, monitoring and evaluation and even out/up scaling. In the daily running of the institute, the deputy director research and technology is the one

who is in closest touch with the "shop floor". He holds various meetings with the assistant directors on administrative matters, planning meetings and workshops, where he echoes the director's line on mission and vision of the institute. But his emphasis is more on programme and project implementation. Thus:

> *In view of the forthcoming review mission, I would urge all of you to submit reports to my office for compilation... I have already received reports from some of you, but it seems to me that we have a problem of format... Reports should show how many crop varieties project x has released, how much milk increase and introduced fodder... and also how that translates...* (Notes on Deputy Director's Meeting 2003)

One of the roles of the Deputy Director is to ensure that annual reports from the research centres are received, and that the annual report of the institute is compiled. This information is given to the publication and documentation services staff, who edit reports assisted by an editorial committee of programme staff at head office. The reports are in a format that shows the projects accomplished, the major findings, and plans for the following year. In enforcing this requirement, the deputy director impresses on the assistant directors in meetings, or through circulars and phone calls, that projects, under their respective programme managers, must submit their reports on time. In a meeting of eight assistant directors and chiefs of divisions with the Deputy Director (DD) of Research and Training in May 2003 the DD said:

> *I have started receiving reports from the centres in my office but I have a feeling that in some centres there were more projects that were funded than is being reported on. An example is KARI centre Uplands where they say that due to late arrival of World Bank funds for the institute projects, a fungicide screening project was implemented and yet this was not in the list of funded projects. Dr K., are you aware of this? What happened? I remember all was well this year unlike last year when….*

Dr K. responds that he will investigate and give feedback but he also complains that the reporting chain is not clear…

> *I thought these reports are supposed to pass through us to you… I am surprised to hear that they are coming direct to you… did you issue a circular to that effect? (murmurs from others who are in agreement that reports are supposed at least to be copied to them).*

Following such a meeting the assistant directors will call the centres to make sure that the projects falling under their responsibility send their reports to the deputy. These reports are important to the institute because it is through this that institute performance is measured. It is an indicator of the utilisation of the resources provided. As the director addresses local and international partners, he refers to the institute's achievements. His own output at this point is essentially a collation of the reports and technical reports from the centres (under labels such as "achievements 2001"). Latour first noticed that the output of science is essentially a set of "inscriptions" (Latour and Woolgar 1986). Here we notice that a key function of KARI leadership is inscription about inscription (as opposed, say, to achieving direct transformation of agricultural field environments). The "bureaucratic" form is an essential characteristic of agro-technology as performed in an environment like KARI.

The meetings just described are also attended by the Deputy Director (DD) in charge of Finance and Planning. This DD official is supposed to maintain a close working relationship with the Deputy Director of Research, and also to ensure timely flow of funds. In this particular meeting he also made a contribution:

> *We are getting to a time of the year when we have to account for all imprests that have been issued to you. You must have seen my email concerning this issue…*

One of the participants, O., raises his hand and comments:

> *On behalf of all of us whose internet connections are yet to be repaired, can the office make arrangements to send us hard copies or [ensure] repairs [are] done?*

The reply is:

> *I have noted this and could the Assistant Director Information and Documentation Services perhaps shed some light on what is happening?*

The AD IDS then assures the meeting that she will talk to the IT unit staff after the meeting.

The DD-F&A then continues:

> *I would like to reiterate the importance of those returns because by 15th of June our accounts are supposed to be complete. This should also be transmitted to the centres and their accounts received in the accounts office to facilitate closure of the financial year. …*

This is followed by loud consultations on what will happen to those activities that are not yet implemented due to late disbursement of funds, which delayed onset of implementation. Submission of financial accounting means a further delay of the implementation of those activities until new allocations are made. The essential incompatibilities of bureaucratic form and the real-time contingencies of farming operations become clear.

The DD Finance then moves on, and another aspect of this incompatibility comes into focus:

> *I remember last year ADs visited their respective programmes in the centres… .although I remember there was a problem where vehicles were shared etc…. Would this not be an ideal thing to do of course assuming that vehicles will be serviced on time this time? You must bear with the situation since there was a bit of confusion last year owing to retrenchment of our mechanics and drivers. This time we have contracted the Corner Garage to service our vehicles and I believe all will be OK. (*DD meeting 2004)

The reference to vehicles is important because mobility in the centres is an issue that directly affects project outputs. Problems occur due to poor distribution of vehicles or occasionally due to poor maintenance. Owing to the increased distances involved, vehicles and petrol are important ingredients of participatory research activities. Due to this greater demand for timely mobility and the associated costs some directors find the farmer participatory research a headache.

Questions pertaining to various administrative issues are then posed by the participants in the meeting, during the "any other business" session. As if to emphasize the point that research is a matter of inscription rather than direct intervention in material reality S. asked:

> *What is happening to the supplies office? I have not yet received response from them and this is the third week since we talked about the photocopier cartridges?*

The Deputy Director answers:

> *I will talk to the supplies officer who sent his apology [for absence] since he is involved together with his staff in the ongoing board of survey exercise.*

Another participant asked:

> *Why is fueling of the cars so complicated? Why does the transport officer have to hold vehicles for hours, and yet the appointments we have are specific? It is very frustrating and Mr DD you have to come to our rescue.*

DD answered:

> *I have talked to transport division and they say sometimes it is the drivers who delay carrying out the fueling they are supposed to do. Do you agree with that??…. (murmurs and consultations of some who agree, others who obviously do not).*

Another participants responds and says:

> *My driver is very responsible. I think the problem has to do with the additional duties added on to the transport-officer's portfolio. He has to check on the servicing of the vehicles and so on……..why can't we get an additional person to help him?*

The DD Research & Technology steps in and announces that this will be dealt with in the next meeting where deployments will be discussed. Later, in the course of that meeting, one assistant director complains:

> *Some centres are hiring drivers and the question is where did they get authority from? …Centre Y hired two drivers and I received a call from another centre that they would like to hire at least one driver because on-farm work is suffering. They planted experiments and they could not collect data as was necessary because of transport problems…...can DD shed light on this?*

DD Research & Training answered:

> *As far as I know [about] what happened in Centre Y, they had a support-staff member who had a driver's license and he was redeployed to driving duties. I would suggest that if Centres have a problem with drivers, and they have staff that can be deployed, then their names should be forwarded to my office.*

A question from one of the ADs followed:

> *In our last meeting we discussed the issue of review missions and their frequency. It seems like we have too many missions. Why are we not given [any] choice to say when they should come? We just hear that next month they are coming and even before they come, another team appears and disrupts our working schedules. The Centres are also concerned that there is too much time spent on these missions. What can be done about this point?*

DD Research and Training replied:

> *I guess one thing that we have to bear in mind is that the discussions on when review missions have to be conducted rests with the donors and the decisions are conveyed to the director. We can discuss this question next time.*

The last response from the deputy director gives a sense of how contact with collaborators is organised. Any collaborator who wishes to work with any government department in Kenya has to contact the highest office in that department. If the collaborator wishes to carry out agricultural research, (s)he has to contact the ministry of agriculture. In a ministry, discussions are held with the permanent secretary, after which future discussions are directed to the relevant divisions or department, i.e. KARI in the case of agricultural research, and within KARI the Director or DD Research and Technology. The manner in which such information is passed on to the shop floor, i.e. the rest of KARI, varies with the administrative approach of the concerned manager and his/her working relationships with other staff. In short, once the bosses have held discussions with the concerned teams, there is an implicit endorsement of their agenda, and hence questions raised after this are seen to be a deviation, or at times insubordination. This leaves very little room for lower echelons to maneuver, , as the agenda is already set. This has to do with, for example, the fact that while approved projects may be on flowers, the priority may be on maize or some other crop. The funds cannot be reallocated to meet the real priority in an area.

Before the meeting ends, the Deputy Director Research and Training announces that the steering committee for the next conference has been constituted and he reads out the names of the members. He reads out names of different task forces and their chairperson. He calls on the chair to convene meetings as soon as possible. He further announces that different from previous conferences, this year's conference will also have a research forum where different research organisations will get an opportunity to display their wares.

The deputy director finance and planning announces that he has liaised with the transport division in analyzing the fuel consumption of different vehicles in the institute. On the basis of the analysis, some vehicles are recommended for bonding and subsequent auction. An assistant director then makes a comment that this is all right so long as plans for how they travel to the centres for monitoring visits will be made.

These meeting vignettes confirm the overall point that KARI is a bureaucracy, and the logic of bureaucratic operations does not combine easily with "out door" operations related to farming, even when these are "regularised" as on-station experiments using standard scientific methodology. A central point about participation is that when a shift to on-farm experimentation is attempted the contingencies multiply enormously. It may seem from the above excerpts from meetings that fuel, vehicle and drivers have taken over from "serious" scientific concerns. This would be a wrong conclusion. The point to be emphasized is that mobility becomes a number one issue in any attempt to align science with the world of farmers. It is clear why research stations were invented in the first place.

Assistant directors and programme officers

As mentioned in the previous section assistant directors (AD) are thematic programme leaders responsible for coordination of research staff in programmes across centres. The ADs are appointed by the chief executive, the director, from among the researchers in the centres, or from among the 15 programme officers at the head office. Each AD may oversee 2-3 programmes working in conjunction with respective programme officers. Programme officers work closely with research project coordinators. The work of the AD is to oversee the implementation of research programmes in their charge, They participate in various institute management meetings and represent the institute director in meetings outside the head office. The programme officers serving under them do the same job on behalf of assistant directors, and are also expected to implement their own research projects in collaboration with research scientists in the centres.

The assistant directors and programme officers once in a while travel to the research centres for monitoring and evaluation visits. These visits are meant to ensure that activities are on course, and also to flag any implementation bottlenecks. This monitoring is more a kind of supervision than the conventional monitoring conducted by the researchers themselves. Such monitoring visits are derogatorily referred to as "snooping" by the researchers. assistant directors interact with research scientists and managers in the centres, and it is this interaction that we now turn to. A centre may get such a "snooping" visit once every three months.

Head office-research centre interactions

In the above meetings, which take place at Head Quarters, different issues related to the conduct of work in the centres arise. The contact with the centres is through the assistant directors, who travel there for monitoring visits or for other reason such as an occasional special meeting convened by the centre directors, centre research advisory committees (CRAC), field days, shows and others. During such meetings, the ADs represent the director of the institute. The statements the ADs make during such meetings are taken to be messages from the director. When one assistant director was asked in an encounter whether he had instructions from the KARI Director General he answered:

> *Yes, …and he asked me to find out from the centre here about the water problem because he is aware of it and he would like an update.*
>
> On the question if he had any special messages the AD responded:
>
> *Oh that one, well, as managers, we always update ourselves on the current things when we visit the centres. We get these "what" and "who" questions from him as he chairs our meetings – in fact he insists that as managers we should be all round and ready to articulate the policies of the institute in the spirit of collective responsibility.*

In the meeting an issue arose on a problem that research scientists were facing, after they were unable to go back to the farms following a diagnosis, due to shortage of funds, despite the promises they made to the farmers.

Commenting on this situation the AD responded:

> *As far as I know you ought to have received funds by now, and it is surprising to hear that you have not. You mean you have not received funds yet? Before leaving Head Quarters, I passed through the accounts office to check if there were any cheques for your Centre. The accountant told me he had dispatched some cheques last week? Was he not telling the truth or what?*

The centre director responds:

> *Yes it is true we received some cheques for this project but what happened was that all the money was put under one cheque. When we divided it among the projects as per breakdown, the money for this particular project was only enough for the diagnosis work. After the scientist finished the diagnosis exercise, we submitted the returns and made a fresh request for the follow up work. That is what Ms N. is asking about.*

AD responded:

> *OK, when I get back to HQ , I will check, but I have a problem with our finance division because once a cheque is sent to a centre, they seem not to follow up to know what happens or when and how much – giving one the impression that to them as long as they send some money their job is done. I would however urge you to make a follow up through my office or directly to their office. However, I will get back to you once I am back in the office.*

This kind of exchange is a common occurrence, particularly where money is concerned. The finance staff are also constrained, because the budgets are received from the Ministry of Finance, and whatever is received, irrespective of the submitted budget, is what has to be distributed among the research centres. This distribution maybe skewed to some centres, according to contingencies or pressures of the moment, leaving others waiting for next time, depending on the priority the various planned activities and programmes have in the opinion of the DG and ADs. This sometimes causes problems, because the rains in the country come in separate periods, which influences the scheduling of research activities. In parts of the Eastern Province, rains are received in October/December. West of the Rift Valley, the rains are received in Feb/March and the rest of the country receives rains in April/May. This means that the projects will not require money at the same time for all the activities.

Nor is there uniformity about when projects start and end. Requirements for specific and timely financing not withstanding, remittances from the head office are all done at the beginning of the financial or administrative year. In addition, it may occur that up to six months will pass before funds are sent to the centres, due to delays in central government financing beyond anyone's control in KARI. This is when the institute director and the deputy director of finance and planning have to contact treasury officials to try and hasten the release process.

Another issue referred to in the above dialogue is the one about staffing. The institute faces constraints in filling up vacancies, either because no adequate candidates can be found, or (more often) because financial resources do not allow hiring of new staff. At the time of this study, there was no single centre that had full complement of research scientists As a consequence some researchers have to do research in a field

different from the one in which they are trained, because implementation of project activities cannot be postponed. This is especially the case with those funded by international donors, where money is "on the table" and donors will grow anxious if is not spent in a timely and agreed manner. The AD for human resources in headquarters in Nairobi is responsible for recruitment, but rarely visits the centres, and hence relies almost entirely on reports from those other assistant directors who do frequently visit the centres, and also on communications from centre directors anxious to fill a gap. Once a case of shortage of staff is reported, the HQ staff checks on the personnel status of the various centres to identify candidates and availability among hired staff, and fills the position accordingly. Such postings often get turned down by individuals, based on health or domestic reasons. When wives are posted to far off-places husbands may raise objections, for example. If no staff can be found, a recommendation on future recruitment is made in a communication to the Director General. During field work for the present study the human resources department had just completed a staffing-norms report and was in the process of completing a staffing master plan. This master plan makes many recommendations on shortages, surpluses and deficiencies, but as of writing, no action has been taken as the recommendations carry financial implications, but there had been no indications that the new project would have a human resource component to allow relevant recruitment.

6. Interactions during KARI events

Other venues where headquarters staff interact with research scientists and other staff include KARI biennial conferences, workshops and seminars. The account below of the KARI Biennial Conference (KBC) tries to convey a sense of the atmosphere, the type of information exchanged, and how the system aims to stimulate quality.

Located between the KARI canteen and the western wing of the administrative-block complex is the brick-roofed KARI conference hall. The tall blue eucalyptus trees on its western side tower over it, as if in attention and watching the participants stream into the hall. Three attendants at the entrance are busy registering participants and handing out conference programmes and badges. The hall is flanked by two small seminar rooms on either side of the entrance. Attendants check badge different colour-codes are visible. On enquiring, the attendants reply that the colour codes correspond to different categories of participant. Later, a KARI employee responsible for logistics clarifies that this is mainly because of security reasons.

At the front of the hall is a table on which a bouquet of cut flowers is placed in a vase, giving the hall a beautiful touch of color. The bouquet comes from the floriculture project of the horticulture center, effectively advertising a KARI research speciality. Inside the hall, a number of participant are already seated and discussing in low tones, as they wait for the first session of the conference to start.

The 9th KARI Biennial Conference, November 2004, deviated from previous ones in that it was the first occasion on which the conference had been twinned with the national agricultural research forum. In this forum, research and educational institutes display their work in tents, neatly set up on the grounds next to the entrance to the head office. It was an opportunity for the institutes to exhibit, and hence account for their existence, to the participants of the conference as well as to the general public. The guest of honour was the minister for agriculture who was officially taken around the stands by the director of KARI. Conference participants were then able to visit the stands and view the displays. The directors of the different institutes in the forum also got a chance to give an overview of their organisations. As mentioned later on in the opening of the session, this approach had to do with the soon to be launched National Agricultural Research System concept, involving all research and agricultural teaching and training organisations in the country. KARI was ahead of the game.

The minister for agriculture officially inaugurated the conference at 9 o'clock. In his speech, he called on farmers to take up technologies produced by KARI and sister organisations over the years. This particular item was prominently transmitted on national television on the evening of 8th November, 2004. The director then called on KARI researchers to step up their research on so-called ''orphan crops'' (i.e. traditional crops) . As an aside he argued for a change name of this category of crops, to remove the stigma associated with them. This observation is a reflection of the ministry's perspective – as also illustrated by a project on indigenous food crops for Eastern Kenya implemented at ministry headquarters. Most of KARI's vegetable projects deal with exotic vegetables and not many projects are carried out in KARI centres that concern indigenous vegetables, a main source of relish and food for the mass of the population.

After the minister opens the conference, key-note papers are read. The first paper is read by the representative of the World Bank in Central, Eastern and Southern Africa. This is as clear a statement as the flowers about KARI priorities. But the keynote-paper ceremony is soon over. Presentation of technical papers – the main rationale for the conference – begins in the afternoon. Each presenter taking the stage finds a microphone fixed to his/her clothes, and begins the obligatory Power Point presentation.

A flavour of the questions is as follows:

> *In your design Ms. M. , you told us that normal farmer practice was used as a check; what is this practice?*
>
> *Why did you use a factorial design in the farm?*
>
> *Why do you say that farmers should use that rate*?

Not all scientists present from the stage. Some findings (often by more junior researchers) are presented as posters erected in entrances and corridors. During this conference, and as is normal practice, the various Power Point and Poster

presentations are evaluated. The evaluation team mingles with the conference participants, each having specific aspects to keep in mind. Criteria include the quality of slides, verbal presentational skills, effectiveness of the response to questions, and general presentational skills and the statistical accuracy that includes designs used, analysis and the interpretation of results. This last bit is particularly important when it comes to the data from the participatory research activities. The data from such activities is subjected to similar statistical processes as any other research data and that which does not conform is either ignored or forced to conform through various statistical manipulations. For this particular evaluation, panel members are drawn from different national universities (Nairobi, Moi and Kenyatta universities, for example).

At the end of the conference, an evaluator gives an analysis of findings:

> *The papers presented in this conference were all very interesting. This is attested by the high attendance at the sessions, with an average of 100 people per day. This is unlike other conferences I have attended where attendance sequentially declines. I also want to take this opportunity to thank KARI management for organising such a conference where CG centers, agricultural para-statals, universities, partners and sponsors could share a roof and listen to the work that has been going on. I believe the divide that has been existing between these organisations will soon be a thing of the past.*
>
> *We evaluated your papers on basis of coherence of the presentations and ideas, organisation of the data and its interpretation. Time management was also an issue as well as quality of visual aids. Based on these criteria we will now announce the second runner up…..(applause), first runner up….(applause) and the best over all…. (applause).*

Awards are then presented to the authors of the winning papers. These consist of a certificate, a trophy and a cash prize. This award is presented to the main author on behalf of the other authors. The prospect of a prize, and curiosity to see who won it, may have been a factor in audiences remaining high until the end.

Another award is made for the best run KARI centre, judged on general management, human resource management (including a register of staff attendance), quality of research programmes, and other such criteria. The assessment is done by a committee, which works under the main conference-organising committee. Following the presentations of the awards, the centre director of the winning centre is given a chance to make a pre-arranged presentation, which mainly highlights areas earning the centre points. The aim here is to enlighten other centres about which areas they might need to improve on, if they aspire to be a winner next time. The director then gives a speech calling upon all researchers to redouble their efforts and learn from the winners the tricks for writing winning papers. He states:

> *Well planned experiments; accurate data collection and analysis besides good writing skills are the winning recipes. I would like once again to reiterate the importance of the work presented to an audience like the one in the KARI conference.*

He then congratulates the winning research centre, on this occasion Mtwapa, for the second year in a row. He invites other centres to borrow a leaf from Mtwapa, and perhaps better still visit the place, and see what lies behind the trick of winning. There is little evidence that prizes reflect issues of research topic or performance that might be of direct relevance to farmers. The overall spirit seems to be that of scientific peer review, where fellow professionals are supposedly the only persons with the knowledge to offer objective assessment. It would be an interesting development to appoint a committee of farmers to award prizes.

7. Interactions at research centre level

The account presented in this section is based on one of the study centers (Embu Research Station). It is fairly representative, however, of the daily routines in any of the research centres in the KARI network. It begins by picturing the research scientist reaching the office in the morning.

A typical day starts with the researchers reporting to the office. This is normally earlier than 7.45 am, which is the official hour for start of work. Observations made over a two-months period showed 45-60% of the researchers reporting to the office before 7.45, and leaving after the official 5 pm closing time. On explaining why they came in so early, some researchers mentioned that they felt that in the course of the day they will encounter lots of time-consuming interruptions. Meetings and other chores , not to mention ''un- announced visits'' to the office, have to be compensated for in order to be able to clear the urgent issues, take action on the incoming tray-mails, and to get ready for field activities (interviews 2004). Researchers who regularly reported early also had staff working under them who also reported early.

This was confirmed by a researcher who remarked:

> *I have developed the habit of reporting to the office early to be able to check on my experiments early and know what tasks I will give out to the technician for the day. You have to do that in order to avoid laxity on the technicians part. When a technician knows that you are aware of the field situation, he will do a good job. I have also learnt this [habit] from the centre director, who always reports to the office long before any of us. He is normally in office by 7am (interview 2004).*

A register is maintained at the reception desk of many centres, which staff sign as they report to work. It is a system that has its origin at the time when centre evaluation committees started making evaluation visits. This register system is used to keep a record of reporting and departure times for the staff. Separate registers are maintained for the different cadres. At the headquarters, a clocking machine replaces the register. The register and clocking machine created quite a furore when first introduced, but they have currently been internalised, with adaptations that allow some junior staff members to beat the system, as will be seen later. The register and the clocking machines fit the notion of an actant (Latour 1986) – i.e. a device (like a heavy hotel key holder) physically embodying a degree of social control. The weight

of the key fob, for example, reminds the guest to give the key back to the desk when leaving the hotel. But despite management ideas, the various KARI actants do not always work as intended, and several efforts have been made to modify and improve their agency. One such is to include the drawing of a line at the bottom of the list of names, or even removing the register after some threshold time, to prevent retrospective additions. In the end, whether to arrive early or not, and the usefulness of an early arrival, depends on a person's integrity and commitment to the overall aims of the work. It matters little to intended beneficiaries of agricultural research if one arrives and just sits in the office staring out of the window.

The centre director – 'no place for failed experiments'

The centre director (CD) is responsible for management of the centre, in terms of providing guidance for the research operations. He/she is normally appointed from among the group of senior scientists in the institute, and has an assistant who helps the administer the centre. The role of a CD is very similar to that of the KARI director. CDs help in the interpretation and transmission of KARI policies, objectives, mission and vision to scientist working under him/her. Through staff meetings, individual discussions and sometimes circulars s/he conveys the intentions of the institute.

A few interactions between CD and research scientists are presented by way of illustration:

On 10th May 2005, researchers of the centre gather in the centre conference hall for a staff meeting chaired by the CD. The staff walk into the room in pairs or threes with diaries, notebooks and pens. As they walk over, two researchers start discussing:

> 1st Scientist: 'I have a big problem with the farmers now that my field vehicle is grounded. I hope in this meeting the boss gives us direction on what to do about these repairs. If nothing happens, I will have to send the TA (Technical Assistant) by '*matatu*' (local bus) to collect data. Otherwise, I am going to lose all the flowering data.'
> 2nd Scientist: 'Why did you not talk to the administrative assistant about this problem?'
> 1st Scientist: 'I did but he referred me to the boss. He says the boss told him not to fix any of the vehicles before he gives a green light because bills have accumulated in the garage and he feels some of our on-farm trips are unnecessary. I wonder why, and yet I hear him talk so enthusiastically about how mindful the centre is of farmer's welfare. Well let us hear what he says about this, but surely something has to be done to avoid more time wastage.'

The scientists get to the hall and mingle with the others. Then the first scientist receives a call from a field front-line extension worker. The extension worker is inquiring about when the researcher plans to travel to the field for collection of the

flowering data. The scientist promises that he will get back to him in an hour's time, after the meeting.

The director then walks in, accompanied by the administrative assistant and the deputy centre director (DCD). It seems they have just come from a meeting in the CD's office, as could be seen from the assistant holding some notes, and from overhearing the discussions they are engaged in as they walk into the venue

One of the scientists - who is the secretary for the meeting - circulates the agenda for the day. The appointment to the position of secretary to the senior staff meeting is based on a collective agreement among the senior staff members, and based on an individual's reliability and personality. Such persons are often senior in terms of years of service. The director then opens the meeting but starts with an announcement which explains why they were late. He points out that he has received notification to the effect that a World Bank mission will be visiting the centre in two days time, and some IARC scientists would like to visit the field trials with the center scientists on same day. He was therefore having a meeting with the centre deputy director and administrative assistant to chart what programme to follow for that mission. He says that he would like to discuss this issue further under "any other business" (AOB).

The agenda items are not many and fall broadly under general administrative issues, technical issues and AOB. Under administrative issues, the CD asks the AA (Administrative Assistant) to talk about the new circular from the headquarters which states the requirement for scientists to declare their private wealth. The AA informs them that this is urgent because if the forms are not returned, salaries will be stopped. He also reminds them about the tax declaration forms. A few clarifications are sought together with a few questions. On technical issues, he asks the DCD to lead the discussion. He starts by mentioning this year's reporting period and deadlines. He indicates that the programme and project reports are expected in KARI headquarter's office of the Deputy Director by 15th of June. He asks the scientists to be mindful of the projects that they undertake at the beginning of the season, and what has been accomplished so far. He raises this issue in relation to his concern about the increasing number of failed on-farm research trials.

> L*ast year, I remember we discussed this issue with you. The numbers of trials that were initiated in the field were more than what was successfully harvested and reported here. Would some one probably want to comment? Yes Mr. B....*

Mr. B. says:

> *I think the problem with the on-farm trials is the highly variable fields which require one to be careful at site selection time. One should not just accept any plot that he or she is shown by the farmer. I remember one time we were shown a plot full of striga seed but we did not know until the maize was close to flowering stage and then the red flowers started showing up and of course the beauty of the flowers spelt doom for our trial. Fortunately we had several sites and this helped a lot. One has to know the history of these fields. Perhaps field selection should be done a season before. But unfortunately most of the times selection has to be done at the beginning of the rains or at times even long into the rainy season due to late disbursement of funds.*

The DCD responds:

> *Why don't you try to come up with the solutions to the problems that you encounter, rather than running away from them? I thought on-farm means testing in the midst of all those problems? For example why couldn't you set up striga management trials in the striga infested plot?*

The discussion becomes heated as scientists give different explanations for trials failing. The director reminds them that at the end of the day they should remember they will be judged on their output in terms of data they collect. In the annual reports they can afford to mention (if they choose to) the failed experiments but in the conferences, journals and other such outlets unfortunately there is 'no room' for failed experiments.

The last phrase is critical, and is at the back of the researchers' minds whenever they are with farmers or collaborators in the field. Whatever happens, the researchers strive to ensure that there is some analyzable data from the trials, irrespective of whether there is input or none from the local research collaborators. Otherwise their participation in conferences as well as acceptance of papers in journals is strongly jeopardised.

This in a way is contrary to farmer perceptions, because they often see an important lesson or opportunity in failed crops or any other technology. They know "where to move next", as Richards (1986) points out in relation to farmer rice trials on catenary soil sequences in West Africa. As Latour (1987) notes about the diesel engine, apprehension and discouragement following the failed original design by Diesel became an opportunity for the MAN company and others to improve and develop today's engine. Farmers are always coming up with such improvements – "on the hoof" - while researchers in many cases give up. The practice can be modified but this then destroys chances of registering a formal inscription, since rolling adjustments are hard to incorporate in scientific method based on "falisification" of formally stated hypotheses. For technology, it is often enough for the device or treatment to work, but in science-based technology development the essential relationship between cause and effect may be lost. Agricultural scientists are driven by scientific peer review to try to work in ideal conditions where "failure" (for which read "incremental adjustment") is minimised. That the best can be the enemy of the good in these conditions has long been suspected, but the ethnographic notes above provide some practical confirmation of the problem.

Funds for trials are then discussed, together with the (recurrent) transport dilemma. The administrative assistant gives an overview of efforts being made pertaining to vehicle repairs and a new contract. He assures the staff that all will be done to ensure that the vehicles are repaired. But he also wonders why all the work cannot be done in the centre, or at least near roads to avoid driving through rough terrain. He refers to a case gathered from a driver:

> *I was asking this driver why there was a dent on his car and he told me that he was taken to through this very difficult track. The driver said he went ''on farm'' and there was this very muddy and difficult road. The vehicle got into a ditch and was pulled*

> *out by villagers who asked the driver to buy them soap for washing their muddied clothes. The driver said he had to part with some money and later noticed a dent on the car perhaps resulting from the efforts of people who were pulling them out, or maybe he hit something. Now, the driver says that you all ask him to go to very difficult sites sometimes.*

When researchers were asked to comment about this situation, and also why they had to select sites that are so difficult to reach, one researcher, an agronomist, said:

> *We select our sites during the dry season, and when it rains the situation changes. You cannot tell how the road will react once the rainy season begins. It is not possible to avoid these situations. However it is also important to realise that these conditions are the same ones that the farmers go through.*

Then one of the breeders working in the Centre reacted:

> *I wonder if it is really necessary to go through all this hassle. Why don't you rely on the data you collect from the institution sites? Must you have sites in those group farms and must they be so isolated? I think these kinds of activities will only help to spoil our centres good name. When you plant and are unable to follow-up because of the conditions then you are getting into a situation that you cannot explain. I keep on saying "leave some of these things to extension".*

The discussion is taken up by another researcher who says that:

> *When the technical advisor of the donor used to be around, I aired the same views about where the TA was insisting on doing work in a real field situation, irrespective of the difficulties. The director, together with some other colleagues, had then called him a politician. But, today, the same things I was saying then are still bothering us now.*

The meeting finally comes to an end after discussing other issues to do with staffing, and conduct of trials in the centre, relations with outsiders, and the proposed visit of the World Bank officials. Scientists continue the discussion during lunch hour when more general issues are discussed which did not come out during the director's meeting. It was possible to discuss these out of ear-shot. Such include the issue of the two very nice cars that the bosses are using, rather than deploying them for research work, as well as cases of recent favouritism in nominating certain research scientists to attend a meeting (with certain benefits attached), while leaving out the relevant ones. It is clear that "participatory research" has its proponents and detractors, but also that it is genuinely harder to manage than on-station research. It is important to realise that on-farm activity does not readily fit with the productivity criteria of scientific research, rewarded mainly through its output of inscriptions. The final (lunch time) conversations introduce us to a layer of "back stage" activity excluded from discussion in formal meetings. It is possible that some of the attractiveness or otherwise of new (or old) research paradigms is to be explained in terms of the hidden advantages offered to those who serve as gate-keepers of resources.

8. Conclusion

This chapter has described how planning and implementation of operations in KARI interact with various internal and external contextual expectations and constraints. How daily routines and procedures are organised, when looked at closely, may seem grotesque (e.g. the constant battles over mobility, as if vehicles and drivers were the sum total of what the institution sought to produce), but these issues are nevertheless the reality of KARI research. This reality – it is safe to say - is absent in formal documents and research reports, hence the value of a "technographic" perspective (i.e. one that discusses the actual social conditions under which technical knowledge is produced). It is these realities of the institutional environment that participatory approaches will sink or swim. Through looking closely at daily routines and procedures an picture of institutional culture begins to form.

The Institute director strives to spell out the need for managers to be focused on the mission and vision of the institute. He repeats the same via the different communication channels through which he interacts with the rest of the institution: biennial conference, seminars and staff meetings at the HQ. He is the connection with the other ranks, but also the voice from the outside. It is appropriate to refer to an institutional culture, where every researcher knows what the institute stands for. This is what Mary Douglas (1986) refers to in stating that a shared symbolic universe embodies definite and distinctive principles of authority and coordination. An institution exists (and can be said to do the thinking) where individuals carry the social order in their heads and project it on to nature.

The "voice from the outside" makes it clear that the smallholder farmer is KARI's client. However, during the trickling down and translation from the voice from on high at HQ to implementation level, constraints emerge, revealing the true nature of the institution as a set of collective values. It is typical of a true institutional culture that these constraints mostly relate to the mundane and every-day. In KARI, vehicles are a central focus for institutional values. They need to be repaired and accounted for to donors. That the nicest machines need to be kept for on-station purposes (contradicting why they were supplied) is a true reflection of the institution's need to protect its core values (in this case the hierarchical order essential to scientific functionality). But the centrality of other apparently mundane issues, vital to institutional survival, also shines through prominently in any technographic account. Budgets need to be prioritised and missions and collaborators need to be attended to. Reports on not yet realised activities need to be filed. Accountancy criteria – e.g. bank checques that for efficiency lump different budget releases – are tolerated despite the realities of farming demands. Field data are collected more perhaps because the researcher needs to make a chance to attend a conference than for the farmer's sake.

It thus emerges in this chapter that there is a strong interaction between overt purposes and the needs of the institution itself. This affects participatory research. Scientists may be genuinely interested to conduct participatory research and even receive feedback, but the appropriate action may not be taken owing to constraining factors associated with institutional survival. Researchers who encounter such

obstacles will take precautions next time round, and this may include avoidance of certain procedures necessary for a truly participatory research. This is in order to avoid, for example, "failed experiments", as stated by the centre director. The striga case offers evidence of this - a plot has to be avoided in order to ensure the expected results. At the extreme, rather than risk failure, it would be preferable to conduct trials on station only and leave the field to extensionists.

While this was expressed publicly by one researcher, it reflects a more general concern shared by various research actors including some managers and researchers, to defend the institution against detractors in a harsh funding climate. In other words, if participation is to be possible, the overall environment has to change, and not just KARI as an institution. Maximally, the entire framework of scientific peer review has to be questioned and suitably reformed if agro-technical research conducted along conventional lines is to establish a link with the world of farmers. The wrong kind of research is the result of the wrong kind of peer pressure. It is the clients of KARI research who should judge the prices.

The existing styles of farmer-engaged research may rightly be dubbed "extractive". Researchers obtain results from participatory research activities with farmers aimed at improving scores in regard to national output goals and to make future proposals relevant for funding, and in the process communities may not benefit as intended. As seen above, the situation is condoned by the managers and adherents (scientists who support) and non-adherents (those who do not support) participatory approaches alike.. In an estimate based on current projects, mode of interaction with farmers and certain attitudes to farmers, the ratio of those scientists who support versus those who do not support participatory research seems to be about 1:3 (2004 interviews). Participation is somehow a residual rather than mainstream activity. An economist supporting participation commented those (like himself) attempting to implement this approach '*are normally left to continue with social issues which the disciplinary scientists are hesitant to deal with*'.

On the side of interactions with external collaborators, it is observed that once interactions have taken place with a higher office, a lower office has no option than to implement and report the shortcomings later. World Bank projects are discussed and agreed at Permanent Secretary level (cf. section above), after which the director of the institute is informed about the plans. It is up to him and his managers to organise appropriate implementation of such projects using the funds they provide. These funds are disbursed through the government treasury in the same way other government funds are also disbursed. Consequently delays are encountered and these have an impact on the conduct of research tightly linked to the reality of the seasons and climate. Issues like these, among others, directly or indirectly affect conduct of participatory research, as will be elaborated in the next chapter. What this chapter has sought to show is that there is a still a long way to go before an adequate scientific practice of farmer-oriented participatory research emerges in Kenya. Institutional factors are only partially favourable. Donors can be criticised for saying one thing and doing another, and of misdirecting effort through imposing their own enthusiasms. At the broadest level, major questions remain to be addressed about

whether standard (peer-assessed) techniques for assessing the quality of scientific output are indeed "fit for purpose" when measured against the challenges of food security and poverty alleviation in Africa.

CHAPTER 4

THE INSTITUTIONAL SHAPING OF RESEARCH PROJECTS: FROM PROBLEM DIAGNOSIS TO OUT-SCALING

1. Introduction

Whereas chapter 3 described the structure of KARI as an organisation, with its procedures and day-to-day routines, in which researchers are aligned, this chapter focuses specifically on the way researchers integrate and act out the participatory approaches in their contact with farmers. The concepts of the participatory approaches were brought in under the influence of donors and their policy advisors, together with a message about a 'need' to apply such approaches in order to make agricultural technology development more relevant to the Kenyan small-scale farmer (see chapter 2). The procedures and events together forming a participatory research process also constitute an interface between researchers and farmers, the two critical sets of actors in the research process. While institutional procedures and practices are the operational context for participatory research, this chapter shows that researchers and farmers are the ultimate determinants of how the research is eventually 'practiced'. This is illustrated by studying the practices of researchers and farmers at the interface, i.e. in the interaction with each other, in two of KARI's research stations - Embu and Kakamega.

The picture that emerges is a complex one. Actor-network theory is used to frame the operations of the participatory research process. The two key sets of social actors seem to come together around the same 'actant' (the research process itself) but they perceive it differently. Scientists look for figures, farmers for output (grain or any other produce), and this disagreement over what research is 'about' seems to betoken very different perceptions of the participatory research process by the two main groups of actors. The difference is attributable to the influence of other actors, beyond the research process as narrowly construed. Scientists have little option but to respond to the demands of the institution and its managers, the donors and the journal articles and reports required to remain in employment. Farmers (many of whom are, in fact, women in female-headed households) are under urgent pressure to feed their dependents. Participation in this case acquires different meanings for different actors.

2. Context

Embu Research Centre – a brief history

The Embu station was one of a group of stations founded in 1952, just before the Swynnerton plan was presented. It was a general investigation station on 180 acres of

land. The mandate of the station was 'to investigate new crop varieties animal breeds and their management, dissemination of information, multiplication of selected seed and planting material', relevant for Central and Eastern Kenya (Agricultural Officer's report, 1963, Dept of Agriculture Annual report, 1963). Researchers carried out investigations on maize, beans, cassava, sweet potatoes, groundnut, horticultural crops, pastures, forage and livestock, and they continue to do so up to the present. Local and introduced crop varieties were tested in the station and according to a report in 1963 by the officer in charge of the station (a Mr. Strange) noted that:

> *Efforts were made to put over the results of the work by means of articles, bulletins, visits from agricultural, administrative and local government officers, lectures and periodic visits to the two regions.* (Department of Agriculture Annual Report 1963)

In a comment about the economic value of the results, Strange added:

> *It is difficult to put an economic value to this work… even if only a small proportion of results gain general acceptance.* (ibid.)

Currently, Embu Research Station is responsible for implementing research projects in support of mid-altitude zones in eight districts of Central and Eastern provinces of Kenya. This zone comprises of 1.7 million ha, of which 1.0 million ha is agricultural land. The centre has a staff of 144, but only 18 (12.5%) are scientists.

Kakamega Research Centre

Kakamega Research Centre (originally Station) was founded in 1956 after the introduction of the Swynnerton plan. . The site encompasses 246 acres of land. The results of the research were intended to serve as recommendations for the whole of North Nyanza (today Western Province). In a 1963 report, the officer in charge, a Mr (Roger) Gray, opens by stating that:

> *Kakamega is the only experimental station in the whole of Kenya serving African farmers only.*[3] (Dept of Agriculture, Annual report 1963)

The aim of the station was to study production factors affecting important local crops, to enable farmers in the area to grow them to their best advantage. This meant that the research station looked at optimal forms of fertilizer, application rates and frequencies of application, etc. New crops were also studied to assess their possible commercial value. New crops, in this context, referred to maize, cassava, beans, groundnuts, tea, coffee, bananas and sunflower.

Much of the work was done in collaboration with the grassland station of KARI at Kitale. In 1963, the officer in charge of Kakamega station, Roger Gray, listed results on appropriate practices of maize planting, weeding and fertilization, suitable sugar-cane varieties, advice on bulking of the produce for commercialisation and distribution of imported cassava and distribution of better yielding black coloured food beans as station highlights. Results were disseminated, he states, through field

[3] Unlike the rest of Kenya, this region's local farmers were involved in commercial maize production from as early as the 1920s. A seed plot in Kakamega is mentioned in the district agricultural officer's report of 1935. (Hoskinson 1997)

days, local small party visits and cyclostyled (duplicated) papers, but extension played an important role as well. Agricultural staff, teachers and other government workers visited the research station to view the work. Adoption and distribution of improved maize from 10-acre seed plots was said to have improved the extremely low yields in the area. Sunflower, chillies and groundnuts were sources of revenue, while grassland work in conjunction with Kitale station was valuable of an because increasing number of grade cattle (i.e. exotic breeds).

Today, Kakamega Research Centre implements research projects in twelve districts of Western, Nyanza and Rift Valley provinces (see Table 2-4 in the methodology section of Chapter 1). The research caters, , for a total land area of 1.3 million ha., out of which 1.1 million ha. is agricultural land. Research is conducted on maize, cassava, sweet potatoes, Phaseolus food beans (kidney beans) and horticulture, in addition to livestock health and production research. Of a staff of 163, 27 (14.7%) are scientists.

Having introduced the two case-study research centers, we now focus attention on two issues that are general to KARI stations, but illustrated from these two centres. The first issue is management of the centres.

Professional performance

A Centre Director heads KARI centres, while sub stations are headed by officers in charge. As already noted, the Centre Director (CD) represents the director KARI on all issues related to management of the centre. He is appointed from among the senior scientists in KARI. CDs are appointed from among serving scientists in the centre itself, or they can be brought in from another centre. Currently, 75% of the CDs have a background in crop-related disciplines, while 25% are from livestock related disciplines. These senior scientists are expected to guide other research scientists in their research processes. According to CDs terms of reference, they are not expected to conduct any research on their own account, unless time allows. In becoming a CD they have passed through a rite de passage, quitting bench science and joining administration, and in effect there is no way back. But this condition also implies the superiority of administration to actual research. Their first priority is to run the centers, and this means they are expected to give guidance to scientists serving under them. But having trained as scientists many find it hard to let go. A look through the proceedings of various KARI conferences and workshops shows a number of papers by these administrators, either individually or jointly with other scientists.

In an interview one CD said:

> *I used to be better off when doing research because I could rub shoulders with maize that asked no questions so long as you give it what it deserved. Human beings are different… no sooner have you solved this issue than another one crops up.*

In response to a question on how he handled all his other administrative duties he responds:

> *I report to office long before the staff so that by the time they arrive, I will have finished reading and answering mail, signed the cheques and answered important*

> *messages. I also talk to the KARI Director at that early hour… he also reports early. I also have a good secretary who is able to keep track of many things that require my attention (pressing the intercom and asking her to bring an extra cup of tea for the interviewer).*

When asked about his views on participatory research, he said:

> *Let me start by saying that good research is what the farmer can make use of. It does not matter what you call it or how you take it to the farmer. Participatory research as far as I am concerned helps us to serve the smallholder farmer through trials conducted in his[4] farm in our mandate districts.* (interviews, 2004)

He then adds that researchers are able to fine-tune their technologies, and even publish papers which they present in external and in-country conferences. He says that in his opinion, however, the situation in the farms makes the publication of these results very difficult and costly, especially when the extra investment of time and risks of failed experiments are considered. He says that from his rough calculation 20-30% of trials conducted with farmers do not provide analyzable data. This means that the scientist's time is wasted, since at the end of the day the scientist has to account for time and funds spent through assessed output. From an administrator's point of view, if the same work is on-station, it is only the scientist's and the workers' time that is wasted when there is a failure. On farm, failure wastes the time of scientists, technicians, the driver and the vehicle and fuel costs consumed. Nor is it easy to know when the trial is failing. Because it is only after the harvest, and subsequent statistical analysis, that one finds the high coefficient of variation that warns that the data are not good. This confirms a point made by Hacking (1990) concerning the tyranny of averages and norms. Sometimes factors beyond the scientist's control like wildlife damage, farmer interference, theft and others come into play, and lead experiments to 'fail'. He then says:

> *Another thing I must say about participatory research is that we do not have a good system of taking these costs and unique conditions into consideration as we assess the work from different projects.*

At this point he picks up the telephone to answer a call from the Institute's Deputy Director (DD) in Nairobi in charge of finance and planning. The DD is inquiring about project budgets for the coming year. The DD 'finance and planning' is the financial head of KARI, and his section has a major influence over the management of the individual projects.

Project management

Prior to the 1980s, decisions on which projects to implement were taken by the officers in charge of stations, and based on station mandates and the interpretation of government development plans and policies through applied research projects. The results would then be passed on to the extension service. The extension service in

[4] Often, the male pronoun is used to refer to the farmers, but ostensibly Kenyan farm work is predominantly done by women farmers.

turn would transfer and diffuse the results to farmers through leaflets, field days, shows and progressive farmer demonstrations.

Participatory research approaches were then introduced to facilitate participation of farmers in the research process, and hence improve on the appropriateness of the research. The current procedure for all research in KARI starts with a participatory diagnosis phase, followed by participatory prioritization, planning, implementation, evaluation and scaling-out (see annex 1??). All phases require participation of research scientists and farmers from beginning to end. Participation is supposed to take place up to harvesting and assessment stage, at which point the researcher takes the 'figures' and the farmer takes the 'produce'. The cycle is usually dictated by a focus on a particular commodity or production factor, and by the available funds. In short, participation rather thinly disguises the deeply institutionalized value system of research for 'figures'.

Financial resources

An excerpt from KARI publicity document reads:

> *KARI maintains collaboration and receives support from international organizations and development partners including the World Bank, European Union, USAID, the Netherlands, Sweden, UK, Canada, GTZ, Japan as well as Foundations such as the Rockefeller Foundation. The support has proved strategic to KARI's performance over the last decade. Donor dependency has declined from 61% to 44% in the last five years but it is still donors who are financing most of the non-human capital and operational costs. (*KARI at a glance 2003[5]*)*

The last statement above is a reflection of reduction in the number of donors currently funding research in KARI, with an exception of the World Bank as the main donor for KARI activities under the National Agricultural Research Project. According to the statement of income and expenditure for the year ending 30th June 2003 (Table 1) the total KARI budget was listed as Ksh 1,462,032,000 (E18,275,400) (at 1E= 80Ksh). Out of this the amount received from IDA (World Bank) was Ksh 324,515,000 (E 4,056,438) representing 22% of the total budget. This was an increase from the previous year (2002) when out of total budget of Ksh 1,444,238,000 (E 18,052,975) the World Bank provided Ksh 249,193,000 (E 3,149,125) which was 17% of total budget]. The World Bank, combined with other donors, accounted for 30.6% of total budget in 2002, and 33.3% in 2003.

Table 1: Statement of income and expenditure for year ended 30th June 2003

Income	**2003 (KES)**	**2002 KES)**
Appropriations in Aid sales		
Goods	46615000	40976000
Services	2816000	4479000
Other receipts	82764000	3843000

[5] KARI Misc reports (2003) KARI at a glance 2003.

Recurrent funds		
Personal emoluments	784639000	761609000
Operational	36000000	36000000
Development		
GOK	22232000	115577000
IDA	324515000	249193000
Other donors	162451000	192561000
Total	**1,462,032,000**	**1,444,238,000**

(Source: KARI Annual Report 2003 p. 219[6])

In a statement from KARI in 2005 entitled 'Looking back 2004, looking ahead 2005', the Director referred to the gap in funding in the following terms:

> *Not everything was rosy during the year. There were low levels of activity in the course of transition from NARP phase 2 (World Bank funded) to KAPP (World Bank funded). We had to slow down activities in the arid and semi arid areas as we negotiated for a new project with the European Union. (*Director KARI 2005[7]*, p 4)*

This was with reference to a transition period when there were few or no operational funds. He further referred to completed and ongoing projects which included USAID funded programme, Lake Victoria Environment Management Programme (LVEMP) funded by the World Bank, a Soil Management project funded by the Rockefeller Foundation, the Desert Margins Programme funded by the Global Environmental Facility (GEF) and a livestock research on Arid and Semi Arid Lands research (ASAL) funded by the European Union. This brings to light the dependence of KARI on donor funds for implementation of its projects. (Table 1). Increasing dependence on donors for research operations is also apparent in the following excerpt from a project review report:

> *Dependency on donors, by KARI, and in particular on short-term donor projects,… represents a monument to unsustainability but also introduces external variables in terms of the research agenda and how these are to be executed (*External Programme Review report[8] 2003)

The two comments are indicative of the role played by donor financing. However, the government and private sector also play a role in funding, as stated in the objective to '*establish sustainable funding initiatives' (KARI Strategic Plan 2000-2010, objective six)*. In the previous chapter a reference was made to the efforts to enter into contracts with vaccine users and dealers. These and other similar efforts aim at generating an income for the institution, reducing dependency on donor funding, but any significant realisation of such ambitions, while possible, may take a long time to be fully achieved.

[6] KARI Annual report (2003) Accounts p 219.
[7] Director KARI (2005): Looking back,2004, looking ahead 2005.
[8] External programme review report (2003).

The point of raising the issue at this point is to highlight the fact that funds, which are the key to research project implementation, are from diverse sources. They come with certain expectations which have to be met. These expectations determine how the money is spent and the tension between expected outputs and the realities of implementation. It is a central fact to be borne in mind in seeking to understand both why KARI turned towards participation in the first place (it was an enthusiasm of the donors) and why KARI implements an orientation towards farmer participatory research in the way that it does, i.e. the language of participation disguises an older set of income-driven practices, which are in fact little changed.

Table 2 presents an overview of the funds used in the Embu Centre. The funds are remitted to the centre through KARI head office. Some funds emanate from other research centres and universities (2.8%), and the projects funded in such a way are mainly discussed and approved in their respective source institutions. It is observed that for year 2003, SIDA provided 41.8% while the World Bank provided 24% and CIMMYT provided 16.7% of total operational budget. These amounts, when compared with the government's 4.5%, may appear unbalanced, but staff salaries and emoluments are covered by the GOK, which is not reflected here. The total financial resources provided by the government to a centre like Embu are higher than reflected here.

Table 2: Embu centre: summary of funds and sources in 2003

Source of funds	**Project**	**Total Amount (Ksh)**	**Amount Euros (80sh/E)**	% **of total**	% **by source**
IDA (World Bank)	Assorted projects	0	78,868	24	24
ODA (UK)	PLEC	130,000	1625	0.5	51.7
SIDA (Sweden)	Agro-forestry	10,972,080	137,151	41.8	
IFAD	Traditional Food Crops	620,000	7,750	2.4	
EROAHI	Soil Conservation	1,443,989	18,049	5.5	
Rockefeller SMP project	Legume Research Network Proj.	404,100	5051	1.5	
CIMMYT	Maize (Various)	1167,584	54681	16.7	17
CIP (McKnight Foundation)	Potatoes	81,400	1018	0.3	
Kenyatta University	Soil Fertility	50,000	625	0.2	1.4
Nairobi University	ECA bean res network	323,756	4046	1.2	

RRC Kakamega Bean	Climbing Beans Production	152,200	1902	0.6	1.4
Thika NHRC	Banana T.C	200,000	2500	0.8	
Government of Kenya	Recurrent +AIA	3142,524	14652	4.5	4.5
	Total	**6285,048**	**86341,818**	**154**	**118**

(Source: Embu Annual Report 2004)

With the exception of IDA funds (World Bank), providing for an assortment of research projects, the other funds (76%) are commodity/factor specific.

3. Research process

Diagnosis

The main objective of the diagnosis phase is to describe and understand production systems and possible interactions in a specific project area. It is also intended to identify jointly with farmers what the key production constraints are, and which opportunities for improvement exist. Based on the findings of the diagnostic study, possible interventions are jointly decided upon. There are two types of diagnosis exercises: a general and a focused one.

A general diagnosis exercise covers entire mandate areas in which representative areas of the mandate region are sampled. In the case of Embu Research Centre five different areas were selected, while for Kakamega Research Centre four areas were selected. The selection of an area is supposed to be based on how well it represents a wider agro-ecological zone, plus a number of other variables determined by the researchers and extension staff in the region.

A focused diagnostic exercise is targeted on specific issues arising from a general diagnostic exercise. These specific exercises may also arise out of specific project needs, for example to document certain management practices in a particular commodity crop, or to understand farmer patterns of agro-chemical input usage. The process followed after the site is selected is basically the same for both types of diagnosis.

Site selection

As mentioned, site selection for a diagnostic exercise is based on different criteria. The exercise followed in Embu Research Centre is presented as an example. A stakeholder meeting was held in 1996 consisting of specialists from various fields related to farming. These experts included research scientists, district extension staff, NGO representatives and farmer representatives. The decision on experts to be involved was made by the research centre management in consultation with the scientists. Based on this meeting, five land-use zones were determined by modifying

the existing farm management zonation and their categorisation. The modification was based on existing practices and resulted in the zonation as shown in Table 3. It is from these groupings that five land use systems were drawn for the diagnosis exercises; the respective sites and districts are shown.

Table 3: Modified farmer participatory research clusters

Land use system(zone) (LUZ)	*Cluster*	*District*
I. Tea –coffee –dairy	Kagumo	Kirinyaga
II. Coffee-dairy	Manyatta	Embu
III. Maize/Sunflower	Mwea/Mitunguu, Kanyuambora	Mbeere, Meru central
IV Dry Highlands*		
V. Sorghum/millet/livestock	Machanga, Marimanti, Kajiampau	Mbeere, Tharaka

*No research was initiated in this zone
(Source: Micheni et al. 1999)

Prioritisation and planning

Following site selection, Embu researchers to identify the constraints that farmers were facing conducted participatory rural appraisals. To this purpose they conducted interviews, diagramming, resource and social mapping, Venn diagrams and scoring, matrix and pair wise rankings which resulted in the ranking of the priority constraints by the researchers and farmers shown in Table 4 and 5 (Micheni et al. 1999). A look at Table 4 shows that the first five problems ranked by the researchers are not all receiving the same high priority although the first three zones showed much similarity in ranking. In zone IV the first three problems are important but are low in priority. In zone V, all the constraints were high in priority as well as importance, which in a way is a reflection of the nature of the agro ecological zone in question, this being a semi-arid zone. In talking about priority and importance, priority measures the urgency of dealing with the constraint while importance is the extent to which the constraint was affecting production in the context of the diagnosis exercise. The line between these two is thin, however. There are also six problems not prioritised by researchers since they are 'un–researchable' (or in the scientists' language 'non technical'). However, farmers view both technical and non-technical issues as priority constraints, and hence likely to influence research activities. In a participatory research process making use of farmer feedback, one might expect an effort to address such issues, *albeit* in terms of consulting with other relevant authorities or knowing the status of the issues, even if they pose a dilemma in terms of capacity, mandate and project focus. This is well highlighted in Table 5 where the first five ranked problems for three selected zones (I,II and V) attract ratings between medium and high, with an exception of problem number 4 which is low in zone 1. Appropriate varieties feature as high priorities (3rd on list) in farmer lists while this is not the case in researcher prioritisations where it is 11th on list and low in priority in zone 1). Problems of infrastructure are prioritised by farmers as being as high a priority as high input costs and land tenure issues.

Table 4: Priorities assigned by extensionists and researchers in major land use zones served by Embu Centre (order of importance, and the level of importance per zone)*

Land use zone	Zone I	Zone II	Zone III	Zone IV	Zone V
1. Low soil fertility/soil erosion	2	1/3	2	3	1
2. Crop pests and diseases	3	1	2	3	1
3. Livestock pests and diseases	2	2	2	3	1
4. Shortage/quality of livestock feeds	-	2	2	1	2
5. Water stress – crops and animals	-	-	1	2/3	1
6. Poor crop management	3	2	-		2
7. Shortage /quality of seeds/planting materials	-	2	2	3	
8. Frost damage	-	-	-	-	1
9. Post harvest storage losses	-	-	-	-	1
10. Poor bee hive management	-	-	-	-	1
11. Lack of improved appropriate varieties	3	2	-	-	-
Listed but not prioritised					
Small land sizes	y	-	-	-	-
Land tenure	y	Y	-	-	-
Lack of credit	y	-	y	-	Y
Cost/availability inputs	-	Y	y	Y	Y
Poor markets/infrastructure	y	Y	-	Y	Y
Lack of veterinary services		Y	-	-	Y

* 1-top priority, 2= medium priority, 3=important but low priority, y-listed as important but not prioritised

(Source: Micheni et al. 1999)

The comparison of the priority listings of researchers and farmers indicates a substantial degree of similarity. It is worth noting, however, that the priority, in the farmer case, is high, low or medium, which in a way corresponds to the researchers' numerical ranking from one to three. A striking observation here is that some problems that researchers perceive as non-researchable rank in the top three of farmer priorities. These are issues such as health, marketing, high input costs, and limited land availability. The other observation worthy of note is that in the farmer prioritisation, soil fertility has a fairly modest ranking (6th on farmers list but 1st on researchers list). It is apparent that soil fertility, which features highly in the listing of the researchers, is not considered by the farmers to be as such. This seems to be a case where the researcher background influences what they see and how they interpret it, and at the same time one might suspect the dictates of a particular project, in which certain issues have to be brought to the fore.

Table 5: Constraints in three Embu mandate Zones as ranked by farmers (first 13 priorities) indicating the level of importance per zone)

Land use	Tea, Coff,Da iry I	Maize S'flower III	Sorghum Millet livestock V
1. Lack of health facilities	H	H	M/H
2. Crop pests and diseases	H	M/H	L/H
3. Lack of appropriate improved crop varieties	H	H	L/H
4. Poor marketing and low prices	M	M	M/H
5. Water stress – crops and animals	L	H	H
6. Low soil fertility/erosion	M	M	M/H
7. Livestock pests and diseases	M	M/H	L/M
8. Infrastructure	M	L/H	M
9. Lack of capital/credit	H	L	L/M
10. Lack of good quality seeds	M	H	
11. Lack of livestock feeds		M/H	M
12. High costs of inputs	M	M	L/M
13. Small land size/land tenure	H	L	H

(Source: Micheni et al. 1999)

It is important to also remember, however, that projects in many cases are associated with government efforts to reach out to smallholder farmers (i.e. they also reflect government priorities) and hence the issue of farmer priorities become secondary to the main aim to be seen to be doing something for poor farmers. Many factors may come into play and determine the quality or extent of participation and hence the input of the farmers in the participatory activity. In the researchers report it is indicated that '*the negotiation abilities of the involved actors in achieving consensus on what activities [were] to be carried out played a role in the exercise*' (Micheni et al. 1999).

The next stage after prioritisation is the drafting of the research proposals by the scientists in which financial endowment of the research project play a significant roel. The funding as pointed out earlier is mostly external (from aid donors or NGOS), but also includes government funds or funding from private companies. Following successful drafting of the proposals, presentation for approval, modification and further advice is made to the Centre Research Advisory Committee (CRAC).

Centre Research Advisory Committee (CRAC) meetings

The committee constituting the CRAC deliberating on planned research projects and recommending them for funding is composed of researchers, extension officers from mandate districts, representative farmers, research collaborators (non-governmental organisations, universities, etc), KARI headquarters staff, and other actors with a stake in the deliberations. The CRAC is alternately chaired by the provincial heads of agriculture or livestock; one chairing this year hands over to the other next year. The

Table below shows the composition of such a committee, from records of meetings held in Kakamega and Embu attended by the author.

A CRAC meeting at a KARI station in 2004
On arrival at the centre, the participants walk into the meeting venue, the centre's conference room, and sign in at the entrance where they write their names, their address, their employer and their designation. A separate list is provided for farmers, who are directed to it by attendants (normally secretaries). Each participant then receives a folder with a document containing the agenda for the day and the reports/proposals to be discussed. They then walk into the hall to settle down and wait for the deliberations to start.

In total, there are 52 participants, gathered in the conference room. In the Kakamega case, three of them are farmers, 23 are KARI staff from the local centre and from KARI Headquarters. In addition, there are 25 extension staffs, including two provincial heads and an NGO representative (Table 6).

Table 6: CRAC meeting attendance-2004

Category	**Kakamega**	**Embu**
Researchers	20	21
Farmers	3	5
Extension	25	13
KARI HQ staff	3	5
University	-	1
NGO+agro-industry	1	2
Total	**52**	**47**

(Source: KARI Embu and Kakamega CRAC meetings 2004)

The Centre Director who also welcomes the participants before calling on the Headquarters representative to make some remarks makes opening remarks. The various representatives often use these opening remarks to make policy statements or proclaim institutional thinking. For example, in the opening remarks of a CRAC meeting one of the Centre Directors stated:

> *The aim of the CRAC is to review and discuss extension and research work under various projects being carried out to promote food production in the region and to alleviate poverty in line with our strategic objectives and mission.* (CRAC meeting 2004)

Following these remarks, the *representative then* briefs the participants on behalf of the Director on the main features of the new Kenya Agricultural Productivity Project (KAPP):

> *And stressed the support to research reform process, extension and farmer empowerment. I urge all of you to familiarise with the new project, as it would have significant impact on the agricultural sector within the next 12 years.* (CRAC 2004)

The Provincial Director of animal production is called upon to make comments, upon which he states that CRAC is a forum where farmers' views are solicited for inclusion in research activities or process. He encourages farmers to participate actively, and quips that in spite of the separation in the Ministry of Agriculture and Livestock Development (MoALD) into two ministries, the farmer remains one. He then gives an example drawn from his former duty station where farmers lacked awareness of the appropriate animal breeds for the region. This resulted in farmers stocking any animal, irrespective of suitability to the area. In the same area, farmers were using embryo transfer and other sophisticated technologies. The farmers were ahead of research staff in the Centre. This was at times embarrassing, when such farmers faced a problem and went to consult with the animal health staff, who were not aware of the technology (Box 3.1).

Box 1: Friesians, jerseys and surrogates

Professionals view practices that are at tangent to the ones they recommend as incorrect, irrespective of the farmer's experiences. The director's reference is to Coast province of Kenya, where despite expert advice to the contrary, farmers continue to stock Friesian cows which are conventionally said to be adapted to cool climates. In the expert's opinion, Jerseys and their crosses are the suitable breeds. Farmers have disapproved this and today, high milk yielding Friesians and other breeds are all over the farms in the Coast region. The farmers argue that feeding the high yielders is cost effective since there is a huge milk demand in the area that the commercial suppliers are unable to meet. In the same region, a private ranch is doing embryo transfer and this service is being extended to local farmers' herds at a fee. This is viewed to be a challenge to the professionals since farmers seem to be ahead of the technical staff.

The Provincial Director of Agriculture, the chairman of this particular CRAC, then takes the floor. He starts by stating that research should follow policy guidelines and above all be demand driven. Pertinent areas like water harvesting should not be left behind and that whenever research is donor-funded it would also tend to be donor-driven. He then notes (challengingly):

Donor priorities are not necessarily our priorities.

He indicates that extension is very important in transferring developed technologies to farmers. He points out that services from the ministry staff are now based on demand from farmers. This is unlike the past, when there was a situation that led farmers to allege ministry staff were nowhere to be seen. He adds that there are other actors who are willing and able to provide services. These actors should be encouraged by KARI to do so. He then proceeds to declare the meeting officially open.

The above remarks are a combination of policy announcements, calling for efforts to improve production, and exhortations concerning the importance of including other actors in the research effort of the institute. The remarks also point to the diversity of sources of information for the farmers, and that as a result of the availability of multiple sources of information some categories of farmers can be ahead of technical staff. The way the director expresses his concern can be interpreted as an indication of his awareness of the potential sense of disempowerment professionals feel when

their skills are challenged. This contradicts the current policy guidelines that advocate for plurality in extension services. This means that any entity or individuals able to provide extension services are free to do so and farmers are entitled to get these services and not to rely on government extension services only. The same also holds true for research services, and an implicit question here is whether researcher scepticism about farmers taking the lead in research is based on hidden fear of professional declassification.

It is also noteworthy that in the meeting, farmers were not invited to make 'opening remarks'. The low numbers of the farmers among the list of attendees is also quite telling. The committee meeting, however, remains a crucial phase of the research project process.

The participants to CRACs are invited by letters and sometimes by telephone calls from centre management. Farmers are invited through their respective extension workers, who are given specifications about which farmers to invite. One such instruction is that farmers have to be able to understand and speak English because the meeting is conducted in English. In addition the farmers have to be 'representative'. This in practice means that extension officers will invite progressive or elite farmers. They are mostly the same farmers who sit in agricultural development committees in the districts.

From Table 6 it is apparent that the number of farmer representatives is quite telling. The three farmers in Kakamega are supposed to represent farmers from the twelve mandate regions of the Kakamega Centre, with a population of 4.8 million people The five farmers in the CRAC meeting of Embu Centre are representative of farmers in eight mandate districts, representing 2.98 million people. While the idea of farmer representation is pursued with all good intentions, it also leaves much space for questions regarding what is meant by 'farmer participation'. It is also not logical to fill the meeting with farmers, since hard professional decisions need to be taken, but on the other hand what takes place seems to be a mere symbolic gesture, with little chance that farmers in meetings will actually be able to speak on behalf of the typical farmer. In part, the issue reveals a real weakness of farmer organisation. In many countries, farmer organisations have their own advisory staffs, and effective means of consultation with membership, so that a few delegates can indeed express cogent opinions about proposed research agenda (Leeuwis 1996) Effective representation at least needs appropriate justification. The CRAC meeting opens up a crucial space for farmer participation in the process, but the space is not yet effectively filled.

Presentations

After the opening remarks, the agenda for the day gives the line-up for the presentations, and one notices the order of presentations with maize, the most important staple crop, on top of the list. Presentations on root crops, legumes and horticulture and other industrial crops programmes then follow. In Kakamega, oil palm and in Embu, Tissue Culture (TC) banana are new cash crops that are included.

The two crops are under the Horticulture and Industrial Crops (HIC) programme. TC banana is a commodity in such high demand that the centre is receiving orders from outside its mandate region, and the newly established facilities in the station are unable to cope.

The presentations are arranged in the way that progress reports of the previous year are presented first, followed by discussions. Thereafter, new proposals are presented. The progress across one section may be presented by one researcher, but individuals are asked to be ready to 'carry their own cross' during question time.

Session 1: progress and extension reports

In the presentation on the maize research project, the researcher first presents the progress of the previous year. He does this using an overhead projector. The reports are neatly and eloquently presented, one after another. One of the issues explained is the attributes considered in national performance trials. He then sums up by saying that the varieties recently released by the Kenya Plant Health Inspectorate Services (KEPHIS) are good and are expected to be adopted quickly by farmers. This raises quite a debate at question time. One of the farmers present asks if the neighbours' maize will spoil his crop since the researcher talked about days to pollen shedding as an important attribute to record. The researcher explains that this is for breeding purposes and the pollen in the field is no problem for food maize. The same farmer says he has noticed that in guava growing zones maize performs very well. The researcher (breeder) asks the agronomist to respond to this and he says he is not sure but speculates that leaf fall from guava plants might lead to enhancement of organic matter content of the soil, from which the maize benefits in the next growing season after the leaves decompose. The same farmer then continues and says that he has heard that GMO maize is being consumed in Kenya and therefore would like the researchers to confirm the same. The researcher explains that insect-resistant GMO-maize is being tested and that the tests are still in their early stages.

More questions are asked following presentation on soil-fertility research with Green Manure Legume (GMLs). These address the economic advantage of using GLMs compared to inorganic fertilizer, and the researcher explains that while no evidence can be provided on that point, it is true that GMLs are locally available and hence do not cost the farmer 'any money' unlike in-organic fertilizer. He also promises to get together with the socio-economist to work out the answer. Someone reminds him that 'locally available' does not necessarily always mean 'easily available', particularly in connection with the labour needed. The farmer has either to hire labour or spend his/her time on sourcing the so-called 'locally available materials'.

A question about Effective Micro-organisms (EM) for composting is asked. EM is a product introduced into Kenya by a Japanese NGO (TENRI society) and farmers are using it, despite conflicting messages from research and extension. The questioner, an extension officer, wants to know what the policy on EM is since the product is being sold and farmers are using it. The researcher is non-committal but smiles as he

states that there is nothing adverse about EM and adds 'that it works'. This last addition elicits giggles from the participants. Later inquiry revealed that wearing a different hat the same researcher expressed his doubts about what he at that time referred to as 'a concoction of coloured water'.

An extension officer questions why he reads in the centres' recommendation that two maize seeds per hill should be planted and later thinned to one. This implies a 50% reduction in the effective utility of the seed purchased, which on a regional basis translates into an enormous waste easily avoided. The maize researcher responds by saying that this practice is used in research to ensure a uniform stand. Poor stand may be caused by low seed viability and early rodent damage. The extension officer reckons that although recommendations talk about the practice, farmers do not necessarily follow it. Some farmers deliberately over-seed for animal feed, but this also means a certain amount of competition. He therefore insists that in his opinion the recommendations should be updated to reflect the reality on the ground.

Another participant calls for close attention to data interpretation, especially where differences are not significant. Some non-significant differences in fertilizer rates call for serious consideration of possible underlying reasons (e.g. non-significant difference between zero application and 30 kg N/ha). Such differences are likely to be due to other causes, he argues, but when they are not explained, it is likely to be concluded that fertilizers up to the rate shown are statistically the same as no application at all, while in actual fact the farmer has spent money on purchasing the 30kg. The yield figures presented also show that there is a difference, but statistics fail to reveal that it is significant. The participant also argues that along the same lines, there is need to think about choice of experimental treatments. These should take into account applicability and feasibility of acceptance by farmers. Farmers would rather make a single fertilizer application than 2-3 splits on an annual crop (which is the recommendation based on research practice).

The presentations move on and the root and tuber crops scientist presents the work on cassava and sweet potatoes. The same format is used as that of maize, with the team leader presenting on behalf of his colleagues. The format is changed somewhat since the section starts with a surprise for the chairman: he is served a glass of sweet potato juice. The juice is prepared in collaboration with the Home Economics and Utilization Section. There is a general buzz by participants as a result of this action. The chairman confirms that the juice is delicious and asks why the maize section never provided any similar samples! He then invites the root crops scientist to move on with the presentation.

The presenter takes the participants through the work of the past year. He presents pie charts showing numbers of cassava cuttings supplied to farmers in various parts of the mandate-region. Someone comments that supplying cassava cuttings for free to the farmers is unsustainable; this has been proven somewhere else. The scientist defends his section by saying that this is a special project that supplies cuttings as a food security measure. Food security is at stake because of a disease that spread from

Uganda wiped out susceptible cassava varieties. The farmers are therefore, through this support, being fast-tracked to return to cassava growing. He acknowledges that probably a small charge would help sustain the effort, and the possibility to set up a sustainable activity that can provide farmers with cassava cuttings will be factored into the project in the future. The researcher then moves from cassava to sweet potato work. He talks of the variety evaluations in the province and particularly refers to the interest in the orange-fleshed varieties. He points out that there is a lack of awareness on the possible uses of these varieties. He mentions the products that can be made from them, including the juice that was just served to the chairman. One of the farmers than asks why sweet potatoes grown in one environment have a different taste when grown in another one. The researcher suggests that maybe there were different varieties planted and therefore two varieties compared, not two environments. The farmer insists that it was the same variety whose taste changed. To end the discussion the chairman asks the scientists to follow up and confirm the reason for this taste difference. Later with the researcher in an informal interview, he mentioned that he felt this was an insignificant issue, which did not warrant further attention since in his opinion*:*

> *The observations of the farmer were just a perception and not based on the reality.* (interview 2003/4)

The interviewer followed up with the farmer who had raised the question in the CRAC. She has been growing potatoes for a long time and said:

> *I can tell one variety from the others through taste and when this changes, I can easily tell. The issue I am talking about is one where the same variety is on two different soil types and the taste is distinctly different.* (interview 2003)

The deliberations continue after tea break and the chairman urges the presenters to stick to salient points in order to be able to cover the agenda. From his estimation, the total agenda might take more than the time programmed. He also appeals to the participants to ask short questions and not to engage the speakers in too much discussion since at the end of all the presentation there will be adequate time for more elaborations. In total 21 progress reports are presented in a session that lasts eight hours, while the original scheduled time was five and a half hours. A coffee break of 15 minutes and a lunch break of one hour are also provided. This brings the committee to the end of its first day of business and the members break off for the day, and are asked to report early the following day to allow time for covering the new proposals.

Session 2: new proposals

The programme on this day starts at 9.30am and since no opening formalities are necessary, the new proposal presentations start immediately. The first proposal presented is on participatory production of clean potato roots and sweet potato vines. In the proposed study the researchers intend to test the optimum cutting frequency for maximum potato vine production and sweet potato tuber yields in different varieties. They expect to identify two high yielding varieties in terms of vines and potato roots and compute technical and economic trade-offs. An on-station study is planned for the first year, followed by on-farm testing. Each variety will be

planted on 6m x 3m plots at spacings of 75m x 30m. Weeding will be at two weeks after planting and fertilizer applied to enhance root establishment and vegetative growth. Second weeding will be done later before the plants cover the ground. Initial harvestings will be done at two months after planting followed by one and a half, two, and two and a half months intervals. Control plots of sweet potato will be cut only once at the end of the study.

The sweet potato study arose out of the observations from the field, as the researcher explains; livestock farmers cut sweet potato vines for fodder but the varieties introduced for this purpose have low root yields. The study tries to optimise the trade-off between two apparently competitive attributes by manipulating the harvesting periods.

After presentations, suggestions are made for researcher to review literature from other KARI centres where similar work has been done, since some of the questions he raises may already have been answered in those other centres. It is also suggested by a colleague researcher to shorten time before going on-farm in the first year, to which the researcher agrees. When asked who will finance the experiment, the proposer says no source of funding has been identified yet. After the presentation, the chairman seeks the opinion of the committee on whether to approve or reject the proposal. The members of the committee unanimously agree to approve the proposal.

Starting on-station with the research work is quite common and ensures that researchers go to the farms with a suitable 'recommendation'. This practice is than compared to 'farmer practice'. The two, for some reason, are assumed to be opposites. In some cases, the only known difference between them may be the fact recommendations are perceived to be exotic and farmer practices are (by definition) local, and in most cases taken to be inferior. Such a (dubious) distinction led to one farmer, as explained by the researcher, to use a local saying - 'every bird pecks with its own beak'. In other words you use what you have to achieve your aim.

The second proposal is on defoliation of maize with the leaves being used for feeding livestock. The proposed study will look at removal of a certain number of leaves below the cob after maize reaches silking stage. This follows earlier on-station work showing varietal differences to this treatment. The researcher intends to work with three hybrid varieties of the 500 and 600 series. The aim is to test with farmers the optimum stage of defoliation and thereafter the post-harvest treatment of the leaves in order to serve as fodder. The extension staff and the farmers raised some questions about this practice. These included questions pertaining to the baling of such leaves, to which the researcher replied there is a hay box of 4 by 3 by 2.5 feet that the livestock unit has designed. Farmers then modified it further to make it collapsible. The researcher added the fact that dry maize stover can be baled but it needs to be treated with urea. He cautioned that this needs to be done carefully since excess urea is toxic to cattle. The usage rate is 50 grams urea per half litre of water sprayed per kg. of stover and this is then covered with a polythene sheet. According to the

researcher this breaks down complex products making the material more digestible. A question followed on use of chicken waste for feeding livestock. One farmer asked if worms in chicken could infest cattle. The researcher was not sure but promised to follow up later. Following the clarifications and questions the proposal was approved.

One of the other proposals is from an agro-based company. It aims at exploring passion fruit production. Preliminary studies have already been done and the company proposes to work in partnership with KARI scientists, a consultancy firm and the farmers. Passion fruit cultivation by smallholder farmers has interesting cash generating potential. Marketing, planting material and technical advice are limiting factors. The proposal is to engage KARI researchers to provide technical advice and planting material to farmers. The company provides a market for the fruits and the consultancy firm provides services on how to run the enterprise. The proposal is to be funded by a micro-enterprise scheme supplying each actor with funds. KARI's role will be to set up demonstration plots and give technical back-up to farmers. The committee commended the company representative for this innovative proposal. It was the first one of its kind and the scientist who was to collaborate with the company was asked to make comments on the technical aspects of the proposal. This scientist indicated that the proposal she submitted in the last years CRAC meeting had all the details and this was a follow-up on the same. She also pointed to the fact that the company representative had forgotten to mention to the committee that some funds had already been released. Through these funds, the scientist had been able to collect some background data on passion fruit cultivation, which she was in the process of analysing. Workshops and seminars had also been held with the same funds.

In total, seven new proposals are presented and all were approved. Different chairmen of CRAC choose different approval styles. While some seek the general opinion of participants by acclamation others ask for someone to propose and to second acceptance, upon which the proposal is approved or otherwise. There are also chairmen who wait for all proposals to be presented, and after that, each is revisited, upon which the chairman asks for comments and clarifications, and it is only after these clarifications that the members are given the go-ahead for proposals to be implemented. A few exceptional cases have also been witnessed where a score sheet was used to ensure that a proposal met set criteria. In this particular meeting, the chairmen sought the participants' opinions and other projects were approved through acclamation.

Cases of projects not being approved were also observed but these are rare. In many cases what happens is that suggestions are made for improvement or adjustments are made to suit certain criteria. Most of these proposals are those that may not have taken into consideration the contexts of the areas that they target with their work. This second session lasted four hours with a lunch break in between. It was apparent that during the lunch break, a lot of discussion ensued amongst the participants pertaining to the deliberations of the meeting. It is also at this time that a number of

extension officers had a chance to inquire about planting materials and seeds from the research scientists while farmers were observed discussing with both researchers and extension officers about certain agricultural practices. The meeting ended with closing remarks made by the provincial director and a word of prayer form one extension officer.

Exceptional cases

CRAC meetings are regularly held in the Regional Research Centres but rarely or never in the National Centres. In one of the former National Research Centres visited in 2003, the Centre Director in his opening remarks stated:

> *The Centre has never held a CRAC meeting, and [we are] pleased and proud to hold the first.* (CRAC meeting 2003)

This situation arises out of the fact that research at the National Centres used to be based on commodity mandates (see Chapter 3) and such commodity research programs used to have their specialist committees composed of researchers and large-scale farmers to deliberate on priority research areas. Some of these committees are still in existence, like the maize specialist committee, although their meetings have been intermittent. In those meetings all researchers in the particular commodity present their proposals and progress reports. Researchers from regional centres involved in this research would also attend such meetings and their proposals – if approved in these meetings – are later presented to CRAC meetings in the regional research for information only. The CGIAR centres and other regional networks support these commodity specialist meetings and it is in these committees that KARI or CG scientists propose their collaborative work .

Once such proposals are discussed in the specialist committees, they rarely change as a result of the deliberations in the CRAC meetings. Any changes would complicate the situation because the protocols and budgets are already decided on and in many cases they also have to tally with work in the rest of the East and Southern African region or East or West of the Rift Valley, and so on.

Another group of proposals that are hardly modified on the basis of deliberations in the CRAC meetings are ones funded by the private sector. According to the 1996 records, 3.6% institute research funds were from private sector. In these arrangements, agro-chemical companies, horticultural firms, and feed manufacturers pay for certain kinds of research and they expect to get results 'on the nail', which they then use in their line of work. This kind of work may be agreed upon through the office or through individual researcher arrangements. This is an issue that has been discussed for long without any decision having been reached as yet.

Various centres are paid 10% of the project costs for administrative overheads, which according to the centre director cover expenses of security, office space, and use of other station facilities. The proportion is not based on a specific calculation and hence utilisation depends on the pooled expenditure of utilities in the station (interviews 2003).

Other centres have different arrangements. In some cases funds from the private sector may be channelled directly to research projects. The point here is that the regulations require that such projects should be discussed in CRAC, but in practice CRAC meetings are informed about planned activities rather asked to approve proposals after debate and chance to incorporate significant changes. The above scenario may partly explain the provincial director's remark (above) that '*whenever research is donor funded, it would also tend to be donor driven and donor priorities are not necessarily our priorities*' (CRAC 2004).

Perceptions regarding CRAC meetings

In the course of this research, interviews were held with participants of various CRAC meetings. In discussions with the extension staff, 40% felt the objectives of CRAC were not met, while 60% felt some of the objectives were met. When asked to elaborate which objectives were not met, some remarked that this '*appears… a rubber stamping exercise*'. A research scientist expressed the feeling that the objective of the meeting was to '*approve/amend or disapprove the proposals and any other objective was secondary*'. All agreed, however, that CRAC meetings were fora where awareness was crated among extension staff and farmers regarding the activities of the research station in the area. The farmers on the other hand were concerned about the distribution of activities over the different districts. They all shared the opinion that the coverage of the activities within the region was not adequate. The research staff on the other hand saw shortage of staff and resources as the main challenges (interviews 2004).

Pertaining to the timing of the meetings, the extension officers interviewed felt that two days was rather inadequate, especially if researchers expected any feedback from the participants.

While there was a general awareness among research activities about the needs of extension staff, some extension staff complained about lack of information in some cases. In some cases scientists have gone directly to the farms to conduct experiments based on their familiarity with the field sites from previous experience. There are those who only involved the extension officers in the choice of the experimental fields and subsequently field implementation was a researchers' affair.

One member of extension staff observed that:

> *The practice of some researchers to deal directly with the farmers undermines our relationship and yet when things go wrong or review missions interview us later, it is very embarrassing to all of us.* (interviews 2004)

One of the farmers asked why they were involved in diagnosis exercises and were then promised that projects will be brought to their area and nothing like that happened. It is a common occurrence that the area of diagnosis and area of implementation are not the same. Other farmers commented that they were involved in all the stages of the research process, including the harvesting, but researchers did

not inform them of the results of the experiments. The farmers thus concluded that the work was for the researchers only. Otherwise how do you explain that at the end of the project there was no more information? When asked about this, the researcher replied that his experience is that farmers are interested in the produce and researchers are interested in the figures, so everyone gets his share.

Another issue that as mentioned by some participants was the scientific language used in the CRAC briefing documents. Technical jargon (e.g. zoological and botanical names) and other terms such as split plot, randomised complete block and so forth, are common in CRAC documents. The researchers defended themselves by saying that there are no local or Swahili words that can be readily substituted.

Implementation

Once projects are approved, arrangements are made for implementation or to adjust and incorporate suggestions made by the committee. The suggestions can relate to technical matters, budgetary issues or site selection. The proposals presented in the CRAC meeting indicate the trial sites but the selection of the farmer groups to be involved is done in the field, followed by plot lay out and planting. Depending on when the CRAC meetings are held, fund disbursement may or may not be in time for the planting season. It all depends on the time when funds are received by the Head quarters from the funding source. Intermittency of funds disbursement is also an issue while synchronisation of financial periods (financial year closure) with planting times is a sensitive issue that results in continuous tensions between financial and technical planning requirements. These are cases where the financial year ends in a month like June, and this may be the moment a certain activity may be scheduled. However, financial requirements are that no more expenditure should be incurred after a certain period. Essential field activities may therefore end up not being implemented.

Site and farmer group selection

According to researchers, decisions on which farmer groups to work with are made jointly with the extension staff at location or division level. At times, provincial administration staffs, including chiefs and village elders are involved. More often however, it is the district and divisional extension workers who are involved, and these liaise with the location extension staff who actually point out the farmer groups within their locations. Normally, the researcher communicates with the extension staff and specifies the kind of farmer group he or she needs. This is based on the crop or animal activity, or stage of research. The researcher may provide specification of agro-ecological zone, gender composition of the group, size of farm plots needed for the experiment, and any other aspect necessary. The divisional or location extension staff then gets in touch with the field workers and explains the group characteristics being sought, area and the soil type, etc. The researcher then visits the site that the extension staff suggested and agrees or not with the selected sites. While particulars of the farmer group, like gender, or any other attribute, may be a requirement, the researchers' major concerns are usually agro-ecological, e.g. climate, soil type, field

history. The verbal confirmation of commitment of the farmer group is enough for many researchers. Very few farmer groups will turn down a request by a researcher to host a research trial. It is taken to be a privilege, as it is assumed to be recognition of the group by the government.

A researcher or technician of the particular research project who was not involved in the diagnosis process may also do selection of the trial site. The connection between diagnosis and the site selection is therefore not always as direct as might be assumed. As a result, the diagnosis is not always done with the farmer research group that eventually hosts the research trials. It is therefore not surprising to find trial sites located far from where the original diagnosis was done. For the same reason, projects may be in the diagnosis area but the farmers involved may be different. It is also not surprising to find a farmer group with some members who were involved in the diagnosis exercise and others who were not. In such a case, even those who were involved may not connect to the current project activity because the problems resulting from the PRA turn out to have been those of the self-declared 'village spokesperson' (cf. Kiptot 2007).

Layout and planting

Once groups and sites are selected, it is time to do plot lay-outs and planting. Plot lay outs are done before the rains, so that the planting operation can begin at the onset of rains. The environment is thoroughly scrutinised to ensure no shade is likely to fall on the plot. Marking involves demarcation and marking of the plot and sub-plots. Preparations also involve a series of questions to the farmer who hosts the plot about the rest of the plantings on the farm and their management: '*What do you intend to plant here? If we want to establish a control plot, where can we do it? What about if we up-root this Napier stand because our plots are always supposed to be "empty" to avoid interference*?'. These questions are asked to 'the farmer' (who may or may not be the land owner) - in most cases she is female. . The pegs are then pushed into the ground to mark the rows and intra-row spacing. All this is done with the farmer watching, and being asked to lend a hand here and there. The researcher explains to the farmers that:

> *This has to be done because the data from these plots will be analyzed and combined with data from Kariara, Kagio and Maragwa (other sites) and the layouts have to be similar.*

A farmer asks what the researchers mean by combine (word used for analyze). He seeks to know whether it means taking maize to all those places? Why not bring the other maize here? The researcher explains that it is the numbers that will be added together and not the maize grain that will be collected together. The researcher then adds one more issue, which surprises the farmers. This is the issue of paths dividing the different blocks in the trial. He indicates that these are paths for data collection and nothing will be grown there. The farmer reacts to this with surprise. Later he explains that this is because the area that the researcher is talking about is as wide as the one about which the farmer was having a boundary dispute with his neighbor. He recovered this piece and now he has to lose it inside his own farm! He shakes his

head and comments '*wonders never cease*'. He mutters that if only he knew it would be like this he could not have volunteered his plot for group work.

After the above exchange, while the researcher continues with his job, the other farmers present look confused and seem to get a different message altogether. This is visible from the way they keep referring to the researcher before they do anything on the demarcated plot. Hence… '*is it ok if I remove this, or that*' (in reference to various issues concerning the plot). A book is finally issued on which they are supposed to record anything/everything that they do in this *'research plot'*. The demarcated plot seems like it is no longer part of the farmers farm and it assumes a new name - it becomes '*shamba ya ngirigaca*' ('agriculture garden'). The researcher refers from now on to the host farmer as the 'research farmer' and the plot becomes 'our on farm plot'.

Planting

The planting involves the farmers in terms of labour provision. On the agreed planting date, often arranged to coincide with a group's meeting day, the researcher arrives and farmers gather at the site. The researcher, usually accompanied with a technician, shows the farmers how to go about the planting. Every farmer is assigned a plot. Depending on the kind of trial, the work will come to an end early or late. Researchers point out that in some cases they have to rely on very few farmers because this is (logically) also the time when farmers are planting in their own farms. In extreme cases, researchers have to hire labour for the planting. Occasionally, dry planting (before the onset of rains) is attempted, but the risks of delayed rainfall are high and hence this is not considered recommendable, even though farmers do it. Planting time is usually a difficult period as one researcher explained. The constraints are not only on the side of the farmers. Also the researchers are faced with delays occasioned by shortage of transport, time demands for other trials in the centres, meetings or visiting officials. This can then create a problem for the farmers. Two projects visited in this research showed the farmers' maize crops (managed by farmers and against which the recommended practice is compared) at tasselling stage, while project crops were at the fourth leaf stage. Hence, the research-farmers commented:

> *When the researchers came to plant two weeks after we had planted our crops I actually thought this crop was earlier maturing than our local maize but I now see that it is not and what we might end up getting is stover for our cows but not any grains.*

In a response to a question on how to improve research, farmers suggested that researchers should be punctual in starting their activities and desist from planting after the farmers had planted since this results in situations where the farmers' crops look better than the researchers'. In majority of situations, the projects are planted on time and the experiments can be used for data collection and monitoring.

Monitoring and data collection visits

After successfully establishing an experiment, researchers or their technicians frequently visit the sites for data collection and monitoring. Visits are made on a pre-arranged schedule estimated to coincide with critical crop growth stages. In maize, these stages are one week after germination, a month after germination, flowering time, silking time and harvesting stage. In between, additional visits may coincide with, for example, a field day or evaluation visit, or a trip by a visiting official, or whatever unexpected reason means the researcher may have to travel to the site area. Sometimes arrangements are made with the farmer groups to take certain data that may be simple to collect, like for example occurrence of certain pests or plant number in trials with a small number of different treatments.

As with planting, the researcher or technician normally tries to plan his or her visits to coincide with the farmer group meeting days to increase the interaction with the farmers. The activity in the trial for such a day then forms part of the group activity. Typically, the researcher and technician are present for planting. But in the follow-up visits to monitor the trials and collect data, the technical assistants come on their own. The research scientists usually have to attend to other institutional issues such as meetings, seminars, workshops or report writing. On average, based on researcher and technician records, researchers account for three out of ten visits while the technicians do the remaining seven. The latter therefore deal with the farmers on a more frequent basis. Basically, the research scientists visit project sites for 'sensitive or strategic activities'. Hence they are there for site selection, preparation, planting and harvesting. In between, the technical assistant collects the agreed data and ensures that normal management practices are carried out as per instructions. Study visits have shown that most of the modifications farmers make to the treatments are applied during vegetative growth of the crop and hence in-between the strategic visits. Participant observations in a participatory research project site revealed that over half of the respondents modified technologies and particularly fertilizer application rate, type and time. The reasons for these modifications varied between inadequate finances and land size to timely availability of labour or labour shortage. The researcher's reaction on seeing the modifications was positive in 39% of the cases and negative (farmers were discouraged) in 41% of the cases. In 20% of the cases, researcher reactions were neutral (interviews 2003)

Technical Assistants (TAs) appears well versed in the farmers' ways. This manifests itself in the manner of communication when the two interact: e.g. tone of voice, words used and a general cordial atmosphere show that both parties are relatively at ease with each other. In the presence of the researcher, the farmers are normally a bit quiet and try to be attentive to the researcher, and address him or her through the technical assistant. For example, the farmer may say to the TA '*ask him if...*', or '*tell him that X is coming to view the project'*, and so on. This situation is exaggerated when the research scientist does not speak the farmers' local language and has to use either Kiswahili or ask the TA to translate. This does not happen in all cases, but is illustrative of the social distance between farmers and researchers.

Finally, when all data are collected, the researcher analyses results, which will be presented in the first session of the next CRAC meeting. The proposal from the former meeting is then completed, once activities over the year having been transformed into a progress report, assuming no financial hick-ups which might otherwise have postponed implementation until the next funding cycle.

4. Other Interactions

Field days/evaluation

Another set of essential activities that take place in the course of the season are field days. Field days not only serve to create more awareness about the KARI technologies but also provide a chance for the farmers to evaluate these technologies. Conventionally, field days are held to demonstrate a range of different technologies and not just one technology. However in the context of research projects, field days are organised around the specific project and technology in question. Innovatively, other aspects of the same technology, besides the one the field day is addressing, are brought in. Hence it is not unusual to listen to discussions about fodder and yet the subject under investigation in the project is insect control. The idea of organising a field day around a single technology seems strange until one takes a closer look at what happens in what can be called a 'uni –technology' field day.

The field days are normally held when the crops are in a vegetative stage of development. For maize, the milk stage or early-dough stage is an ideal moment for evaluation; the vegetative performance can be a good predictor for yields. Such a field day is therefore a critical event in the life of the research project. Researchers say *'this is when farmers make their input into the project'* (interview 2004). Others feel that this also a stage to teach farmers about the importance of the treatments, with an example here being soil fertility trials, because major nutrient deficiencies show up at this stage. One researcher confided that this is what makes the trials participatory, because the farmers who also give their opinions on being asked by researchers collect data. The data collected is then analysed by the scientist, but this excludes farmer opinions on the grounds, according to one researcher, that they are not 'quantifiable' and '*in any case our data sheets do not have room for such farmer opinions*'. A few experiences on maize fertility trials, insect control, tasting panels and potato-tuber seed field day are presented in Chapter 5 to highlight the varied approaches to the process.

Agricultural shows

Agricultural shows are functions that trace their roots from the colonial times, when settler farmers would exhibit their crops and stock. Sales and purchases would be transacted, and thus exchange of germplasm and stock between farmers would be facilitated. The tradition has continued under the auspices of the Agricultural Society of Kenya (ASK). Every province and some districts have major shows while some divisions and locations also have 'Harambee Shows'. The Harambee Shows are

organised by local authorities in conjunction with the local business community and are mostly commercially oriented. They provide avenues for interaction of farmers with researchers, however.

The show calendar is coordinated by the ASK management and culminates with the Nairobi International Trade Fair in the month of September. As evidenced by the title, the original agricultural show is now almost entirely masked by trade concerns. The original idea of farmer competition is still found in one stand called the Farm and Diary stand where even now produce from different parts of the country is displayed, judged and awarded prizes. In all shows there are still livestock judgings and parades, while at the coast and in the North Eastern Province the shows still include, respectively, fish displays and camel parades. KARI Centres participate in these shows. KARI normally displays different technologies indoors, and also has a demonstration plot outside, managed by the institute alone or jointly with the Ministry of Agriculture. The shows are publicised through the electronic and print media and they last for a week. Embu and Kakamega Research Centres participate in their district and provincial shows and also contribute display items to the national event where the institute has a stand representing all KARI centres. Embu Centre usually supplies sweet potato displays and Kakamega provides sorghums and millets and indigenous vegetables for display in the shows. The Coast Centre supplies coconut and cashew nuts and other typical coastal products for all other centres and their specialisations. Farmers are able to access information on the technologies from the scientists who service the stands and demonstration plots. The climax in each of the shows is the visit to the KARI stand by the Head of State. In the other regional shows, local dignitaries visit the stand and this draws attention to the institute. It remains an important avenue for exchange of information between scientists and farmers.

In interviews conducted in two such shows, 35% of respondents stated that agricultural shows were their main source of agricultural information, followed by extension agents. While this is not a specifically impressive figure, the importance of the show may easily be underestimated. Farmers go to the shows with their families and the yearly outing gathers large numbers of people, the majority involved in farming or services that directly or indirectly supports agriculture. It is an occasion where the urban members of the farming community normally show up, such as children of farmers and their relatives, and absentee land owners (telephone farmers). As one urban resident said '*this is an occasion when the farms or gardens visit the towns and I always look forward to these events as they remind me of my boyhood days in the farm'.*

Farmer research centre visits

Farmer visits to research centres have gained a lot of popularity since the advent of participatory research. It is one of the activities that provide farmers with a first-hand opportunity to observe how the technologies being tested and utilised in their farms are developed in environments that are different from their own. The visits also provide a chance to exchange views with researchers on the various experiences

farmers have had with the technologies. Farmer visits to the KARI Centres are normally organised for the farmers by NGOs and farmer service providers In some cases, however, the farmers take the initiative by pooling finances and hiring transport to take them to the Research Centres. The organisation and management of the visits therefore varies from group to group and according to specific interests. Individual farmers also visit the centres for consultation or just to get a general overview of the technologies available. The farm manager or his or her assistant takes around such farmers, but occasionally a technical assistant may be assigned the role of taking visitors around the centre.

For a group of farmers to visit a research centre, a number of arrangements are needed to ensure that once they reach the centre someone is able to discuss with them and show them the various experiments in the centres. The arrangements start with either a letter from the facilitating NGO or service provider to the Centre, or an emissary being sent to set up an appointment. The letters specify the proposed visit date, the number of people in the group and the specific areas of interest. Such requests are either accepted as they are, or suggestions for more suitable days are made, basically to avoid overlap with other activities that may be taking place on any single day. Relevant researchers are then informed of the particular groups visiting and their areas of interest. A letter of confirmation is sent back to the group with information on the person or persons to meet them on arrival at the Centre. The groups may sometimes alter the dates of their visits depending on how early the booking is made or may go ahead and visit on the specified day.

On arrival to the centre, the KARI staff member responsible for the visit gives the group an overview of the centre and the different programmes currently running there. They are then conducted through the various demonstrations and experimental plots in the centre. During this visit they ask questions based on their interests and engage in discussions based on their experiences with the particular technologies being observed.

The visits end with the farmer groups buying some seeds or planting materials from the centre nursery or technology shop. In 2003 approximately 250 farmers visited Embu Centre. Of these 57% were males and 43% were females. The interests varied between livestock (34%), fruits (23%), fodder (26%) and general crops (17%). A significant rise in farmer visits has been observed since 1996, and according to the Embu Centre Director and researchers this can be directly linked with participatory research activities. Besides farmers, school parties also visit the Research Centre owing to the inclusion of agriculture in the school curriculum. This is an activity offering an opportunity for a lot of interaction between the scientists and the farmers, and students and the research practice stand to benefit as well as the farmers. Presently, there is no clear institute policy on such visits, and hence different centres handle them differently, though of course the tendency is towards an open door policy to all farmers. Open days when farmers and the general public visit the centre and booked visits are an indication of the importance and recognition accorded to

the various institutes, but there are as yet no clear guidelines on how they should be conducted.

5. Discussion

Farmer-researcher interactions provide opportunities for exchange of information and ideas between these two principal sets of actors in the agricultural sector. One thing that stands out, however, is the fact that throughout the interactions described above, the farmers who are targeted are the small-scale farmers. A reference to the benefits derived on farm is made by the Centre Director who states that researchers are able to test their technologies on farm and hence fine tune them. Publication of papers in national and international journals is also another one. These references are important to bear in mind because often the operations in the activities are likely to be shaped by such objectives. Administrators' concerns for failed experiments are an interesting aspect, which tends to raise the question of how farmers cope with failed experiments. Richards (1989) argues that farmer practices are complete performances in real time and space, unlike researcher interventions frozen in time and place. We observe ambivalence here, where concern for data interferes with the flow of problem solving in real time on the ground, and hence clashes in terms of output and implementation are not really surprising.

Researcher prioritisation versus farmer prioritisation.

Farmers and researchers priorities are observed to differ, as can be seen from the above descriptions. This raises the issue of research institute mandates. At times, prioritisation may bring out issues that are within the research mandates of the research institute, but the financial resources and personnel may not be available. Diagnosis may have been focused on a particular crop and when other issues emerge the chances of leaving them out are quite high when research is actually implemented. It does not stop one from thinking of the reality on the ground when farmers find themselves participating in an activity which is not in their direct interest. In interviews with farmers in one project area, 94% of respondents expressed satisfaction with the focus of the project on their problems and 6% felt there were more pressing problems than were addressed in the project diagnosis. One commented thus: 'R*oads are our major priority in this area and so the government should help us to construct them to be able to market our produce*' (*interview 2004*).

While government policies on agriculture are followed in deciding which projects are to be implemented, a lot of what eventually gets implemented depends critically on financial resources and their source, and availability of personnel. This introduces a situation where certain aspects government policies are likely to be omitted due to lack of required financial resources. In an effort to address farmer priorities, the institute launched an outreach project that invited proposals from farmers, upon which seed money was then invested (Kamau et al. 2000). But it has to be admitted that taking farmers 'integrated' sets of performative concerns seriously is often much more complicated than simply designing a set of on-farm, with-farmer experiments.

Perception of professionals being challenged

In the committee meeting, a statement by officials pointed out to an issue that is often controversial, in the form of challenges to professional expertise. When farmers who have multiple sources of information practice highly skilled tasks, they pose a challenge to professionals competence in their respective areas. This is an issue that is likely to confront the government extension service and even researchers as new players become poised to become involved in extension and research service delivery (a growing trend under privatisation in Kenya). As exemplified in the sweet potato case, researchers often contest or disparage farmers' experiential knowledge. The taste issue alluded to by a farmer may make inform local decisions that the researcher then simply fails to understand or anticipate, since he/she has a pre-determined opinion about what constitutes a valid or accurate observation. Such experiential knowledge is often manifested in modifications and adaptations that farmers make in the technologies. The general issue is that knowledge systems issue competing claims about what constitutes a resource and how to develop it. Where such claims clash it is not certain where the judge and jury are to be found. The tendency is for the superior social and financial status of 'formal' research to flatten interesting local initiatives.

Farmer participation in CRAC

Farmers and other stakeholders are invited to give their views to fulfil policy guidelines in CRAC. Their views are listened to, but from the experience, they are more vocal on progress reports than in critiquing new proposed activities. This may have something to do with the technical nature of the proposals and the language used. In reference to this issue a participant called for simplification of the CRAC document for farmers to understand. This is an issue that also applies to standard recommendations, often said to be too technical for farmers to understand. While this effort to involve farmers is being undertaken, much still needs to be done to engage more thoroughly with the consultative/participatory-planning process better to identify interventions to farmers' problems. Collaborative partnerships among agricultural stakeholders, as exemplified by company proposals, could utilise synergy between the different groups of actors and hence provide new kinds of solutions to many farming constraints (see Chapters 5 and 6).

Going it alone, leaving out the partner?

In participatory research, the main issue is partnership with farmers and other relevant actors. As raised in the various interactions, researchers often leave out farmers. It is helpful to understand the crucial junctures at which farmers tend to be dumped. In diagnosis, the selection of sites and the later selection of trial sites is one stage where farmers often tend to be excluded. They also get excluded at the project planning stage. In layout, they are excluded when marking and lay out involve sophisticated, land-intensive designs. Lateness in establishment also denies farmers chance to compare practices. In field days, exclusion often takes the form of methods

used for evaluation. The final stage is in the harvesting when as one researcher put it farmers 'take the produce and we take the figures'. It is true that some trials require a different kind of participation than others, but method need to be found at all these junctures to guard against farmer exclusion.

In one site, a total of 88% of respondents interviewed participated in evaluation while 12% did not participate. Various attributes were used for evaluation, with yields being highest on the list (cited by 40% of respondents) followed by management issues (20%). Asked whether they received any feedback, 72% of respondents said they received feedback, while 28% said they did not receive any feedback from researchers (interviews 2003). These figures are encouraging, and are a measure of the seriousness with which some Kenyan agricultural researchers treat participation.

The observation that *locally available is not easily available* aired by one participant is often assumed in many situations. The research setting creates a situation that slights the involvement required to access some of the inputs that seem (wrongly) to be so easy to get. This is perhaps linked to the scale at which research operates. A three by five metre plot used to assess the green manure legumes and biomass transfer materials like T*ethonia diversifolia* and then extrapolated to kg./ha. translates to a lot of material which it may be impractical for farmers to handle. In the case of Green Manure Legumes, rotation is handicapped by the small land sizes considered, and the fact that the grains from such materials as Mucuna are inedible (Misiko 2007).

Beneficial outcomes from participatory processes

Farmer collective action is an instant beneficial outcome of the participatory research activities being implemented. The farmer research groups, and associated discussions about research technologies, allow the farmers to exchange ideas. The visits to the research centre as was pointed out by the researchers were not as common before advent of participatory research as they are today. This provides farmers with more exposure to more technologies.

6. Conclusions

The analysis of the research process in KARI shows that participation of clients in research, in this case specifically by small-scale farmers, is taken seriously by the institution. The spaces for participation are mostly in diagnosis, in CRAC meetings, and in on-farm trials. A point for debate is whether these spaces are effectively used. Participating small-scale farmers seem to be selected on a number of criteria that seem not to be closely related to the reasons of having participatory research on agricultural technology. For researchers, the first priority is to deliver 'good quality research data'. Researchers are assessed on their output of scientific publications, papers and presentations in meetings and conferences. Form the researcher perspective, on- farm research has to be carefully managed in order to produce reliable and analysable data. This results in tensions affecting the underlying reasons

for use of participatory approaches, i.e. to develop technologies relevant to the small-scale farmers. Because farmers modify treatments, and plots are located on heterogeneous soils, results do not always stand up in a scientific conference, if at all the researcher gets permission to go there with research outcomes that seem hardly interpretable.

Outside factors also hinder meaningful participation, because a number of proposals circumvent stakeholder reviews, so as not to interfere with financial planning or risk disapproval for a proposal by a private company or a segment of a set of international comparative trials. While this circumvention is logical because disapproval would disrupt planning and budgeting for international collaborative research it undermines the spirit of the planning meetings. Members are left at a loss when statements are made to the effect that such and such proposal has already been started or very little input is required apart form 'for your information'. Regrettably, this is the work that KARI carries out with funding from outside sources, constituting in some cases up to 50 % of the total research budget of a project. This leaves a question: is stakeholder participation in the planning phase of KARI research not mostly a type of decoration or (as expressed by some members) rubber-stamping, to vaguely assure 'poverty relevance'? But externally funded research is not necessarily the enemy of meaningful participation. Chapter 1 shows that quite a number of international collaborators notably CIMMYT, DFID and KIT played a major and useful role in supporting the development of KARI staff capacity for participatory approaches. These are (Murithi 2000, Mukisira 1998, Sutherland et al. 1998).

Participation in the diagnostic phase is clearly an extractive type of participation. And yet the usefulness of stakeholder participation in this phase is difficult to deny. Changing from a passive participation in this phase to a more active one might be wishful thinking. It would, of course, be desirable that farmer groups had a more determining influence on the research agenda, but reality is that the diagnosis takes place in the context of the KARI mandate, being agricultural technology development in crop and livestock areas for which KARI has been assigned responsibility by the Government of Kenya. In the implementation phase, participation of small-scale farmers also does not seem optimal, when taking the usefulness of it for the farmers as priority criteria. However, as indicated, for researchers the assessment is based on their 'scientific output'. Combining the development objectives with the scientific ones is an outstanding challenge. New incentive schemes and new ways of assessing scientific creativity and output quality, adapted to the needs of participation, are now needed.

Last but not least, this chapter has helped make clear that research processes and procedures are embedded in specific institutional environments, and that these environments exert a strong pressure on researchers in terms of administrative compliance (reporting, budgeting, etc) and coordination (meetings). In addition, researchers have to 'promote' KARI technologies and spend considerable time in field and demonstration days, and receiving client-farmers on centre visits. In such

conditions researchers do not always find adequate time to carry out participatory research to the standard required. Making participatory research work will require very precise attention to releasing the kinds of constraints posed by working environments, as indicated in this chapter.

CHAPTER 5

RESEARCH SCIENTIST AND FARMER GROUP INTERACTIONS

'Case studies – farmer research groups and other groups '

1. Introduction

This chapter gives an account of how through the group concept the research institute implements research activities. It is an attempt to illustrate how, in the context of the research, participation is operationalised and same is done somewhat differently by farmers, thus illuminating the notion of counter-tendency. This brings into discussion the manner in which farmers organised in groups implement their own agricultural production activities through various trials and experiments, thereby giving rise to farmer innovations or farmer recommendations equivalent to research recommendations. An essential difference between these two is the fact that while research recommendations are packaged into leaflets and technical bulletins and communicated through published papers and journals, farmer recommendations are manifested in farming practice and communicated verbally and visually. While the former remain fixed by their mode of communication the latter are dynamic and continuously modified in keeping with the flow of circumstances, as a result of which the farmers are able to resiliently make a living within a very heterogeneous environment. This contrasts with the research recommendations that often fail to work when subjected to dynamic environmental circumstances, leading to the often heard (but unfair) criticism of farmer ignorance or backwardness. The chapter argues for a middle ground between farmer recommendations and research recommendations, but against the 'conversion' of farmer recommendations into scientific modes of representation, as often happens when researchers compare their own recommendations with farmer practice.

2. What is a group? A definition

There are different definitions of the notion 'group' based on interaction, interdependence, structure, self-categorisation and social identity. Giddens (1989) defines 'group' as a number of people who interact with each other on a regular basis which welds them together as a distinct unit with an overall social identity. As such, members of a group expect certain forms of behaviour from one another not demanded from non members. Groups differ in size from small family units to large sports clubs. This definition excludes aggregates, defined as collections of people at the same place but sharing no definite connections with one another (e.g. a crowd in a bus station) or people in unfocused interaction with one another (e.g. a queue waiting to enter a bus). Groups may be divided into primary and secondary groups with the former referring to a small association of people connected by lasting emotional bonds. The latter consists of people who meet regularly but whose relationships are mainly impersonal. Individuals in secondary groups come together

for specific practical purposes. This chapter makes use of various authors' definitions of the concept 'group'.

According to Shaw (1981) a group is defined as persons interacting with one another in such a manner that each person influences and is influenced by each other person, while Lewin (1963) defines a group as a dynamic whole based on interdependence rather than similarity. Turner (1987) defines a group as individuals whose relations tend to become stabilised, organised and regulated by the development of a system of role and status differentiations and shared social norms and values prescribing beliefs attitudes and conduct in matters relevant to the group. Brown (2000) defines a group as existent when interacting persons define themselves as members of it. This last definition varies somewhat from Turners (1982) definition that a group comprises individuals who share a common social identification of themselves or perceive themselves to be members of the same social category.

Each definition is an attempt to understand how we know when we have a meaningful group rather than a collection of people who appear together in one place and yet may not be a group. The quality or characteristic that brings people together to act as a group is an elusive social fact. One of the key characteristics or manifestations is similarity among members. People sharing similar opinions and beliefs, or who engage in similar behaviour, may appear to be in a group. However, differences in values, beliefs and behavior may render them not to be classified as belonging to the same group. Worshippers in the same church service, for example, may in fact have such a range of personal interpretations of deity that, were they to define their beliefs, they might find themselves in distinct and perhaps opposed camps. Appropriate group goals when shared tend to keep groups together and the achievements of such groups tend to be greater than those with dissimilar goals. A key to group performance, therefore, is finding a small range of shared activities or aims around which a group can focus.

Farmer group – a definition

In the context of this thesis, a farmer group is defined as individuals who share a common goal of searching for the means to sustain their livelihood through the practices of farming. Farming group members dynamically interact with one another and accept expectations and obligations required of them by the group. They share certain values, beliefs and backgrounds, as well as various dynamic social-cultural, economic and biophysical constraints. They interact (or could interact) with research scientists through a shared interest in research work through which they might expect to access additional skills and technologies to resolve agricultural production challenges. This definition closely follows that given by Turner (1987) who cites shared social norms and values prescribing attitudes and matters relevant to the group.

3. KARI research scientists and their interaction with farmer groups

Research scientists implement their research work through groups. This is an approach advocated by the ministry of agriculture. The ministry's approach changed from an individual to a group approach after encountering various challenges. One of these challenges was the low diffusion of technologies from progressive farmers to the rest of the farming community. The individual idea (work first with progressive farmers) was based on the transfer of technology model (ToT). This failed to consider that the environments suitable or homogeneous enough for innovations adopted by progressive farmer would also be necessary for the other farmers. But poorer farmers typically lack the good land and other stable input conditions enjoyed by the so-called progressive farmers. The scenario replicated the one experienced with the high yielding varieties (HYVs) of the Green Revolution technologies (GR) which diffused rapidly in favorable (homogeneous) environments – such as the water-managed wetlands of the Asian rice bowl - but failed in more heterogeneous conditions (e.g. variable flood conditions for wet rice in Bangla Desh).

A second challenge in Kenya was lack of sufficient staff to visit individual farmers. This was a change from the conditions envisaged by the Swynnerton Plan, where every extension staff member was expected to visit a certain number of farmers. In pre-T&V days, every staff member was expected to visit a limited number of progressive farmers within his/her extension area. The same was attempted with T&V, where every front line extension staff member was supposed regularly to visit nine 'contact' farmers with a new message handed down from the research institute through the subject matter specialists (SMS) (Bindlish et al. 1993). Demonstration plots were planted in these farmers' sites where other farmers were expected to converge and learn new production techniques. On-farm trials conducted following diagnosis and planning in the farming systems approach were set up in individual farmers' fields from 1983 onwards, and in some cases in contact farmers' fields. The research scientists would then deal with only that particular farmer. A continuity from the colonial system to T&V is thus apparent, since the basic operational approach remained the same, despite the change of terminology (from progressive to contact farmer).

The above individualised approach failed, since several key operational and logistical factors were not taken into consideration, and a shift to the group approach was made, further reinforced as participatory approaches sought more involvement of farming communities in the research processes. A key choice was then was whether to form a new group or select an existing group. These were decisions made by the respective research scientist and the system applicable from area to area, as discussed in the next section.

Group selection

Group selection and site selection go hand-in-hand, as mentioned in Chapter 4. It was here indicated that site selection is based on the information provided by the

research scientists to the collaborators. Here we shall look more closely at the selection of the groups for participatory research activities.

As already shown, participatory research activities start with diagnostic activities conducted in certain selected areas, based on agro-ecological classification. This is also the initial stage in selection of the groups, since application of zonal criteria will determine which groups are available for selection.

Many approaches to group selection are followed but the most common strategies encountered in the course of the present study can be broadly grouped into three categories. These include selection by extension staff, selection based on previous experience with a specific group, and selection among groups involved at diagnosis stage.

The process of group selection through extension staff involves contacting the extension officers and providing them with group specifications - for example, group size (*x* number of members), group typical age (e.g. youth groups), group composition (men or women, or mixed groups) or group activity (livestock keeping, fruit growers, maize growers, etc). A research scientist may specify the number of women's men's, youth and mixed groups needed. In many cases, group activity overrides the other criteria, since researcher interest is based more on specific line of research than the other group characteristics. This means, for example, that as long as a group engages in, for example, maize growing, a maize specialist will tend to pay less attention to the other attributes. However, the extension staff may also influence the kinds of groups selected, based on past experience (e.g. are they cooperative, or strongly led and thus easier to handle).

The second strategy is to select groups that a research scientist or a colleague has previously worked with on a project along similar lines. A research scientist who may have completed working with a group may introduce a colleague to 'his/her' groups. This reflects the trust that has built up between the researcher and the group members as project implementation progresses. This trust is 'social capital' passed on to the new researcher. It is a way of guaranteeing results, even if it means creating the group equivalent of the untypical 'progressive farmer'. Researchers are under constant pressure to produce viable results. Working with unknown farmers in difficult conditions risks delaying results, or even complete failure. However, even in such cases, the extension may still get involved, since they are supposed to be notified of any research work taking place within their areas of operation. It would in theory be possible for an alert extensionist and especially the front line extension workers (FEW) to draw attention to the fact that groups regularly and repeatedly involved in participatory research activity have ceased to become typical of the mass of farmers in her/his area. This seems not to happen and perhaps reflects status differences between research and front line extension workers (researchers are more highly qualified, for example).

The third approach is one where a group selected at diagnosis stage is later involved in the testing. As earlier mentioned, an attempt is made during the diagnosis exercise to obtain as diverse views as possible. Farmers interviewed for diagnosis are thus a known quantity, allowing the researcher to quickly specify as suitable sample of groups with the requisite diversity.

Where other group selection procedures are adopted this very much depends on the research scientist. In a few cases new groups are formed at the research stage, but from my discussions with the research scientists, these cases are not very common. In the opinion of some research scientists working with completely new groups is complicated by the fact that a lot of time is wasted in the formation process, while groups organise themselves and brainstorm before they start performing.

As mentioned in the CRAC meeting, involvement of the extension staff in the course of project implementation is a contested issue. Some researchers deal directly with groups and keep the extension staff in the dark. When asked why this happens, one research scientist explained:

> *I feel this issue has been blown out of proportion because extension staff are supposed to be working in this area anyway with or without research activities, and [yet] every day that you involve them, you have to pay them their allowances.*

A number of researchers interviewed only involve the extension staff at the initial stages, and in the other stages they deal with the groups directly. This issue is a serious one in some situations, because owing to such attitudes, it is not unknown for extension staff to give instructions to the farmers contrary to what the researchers intend. Examples include when and whether to harvest a crop without researchers being present (whether to harvest at the right moment for the researchers to come and weigh later or to leave it in the field until they turn up). The reason for this is that though there are these issues between the research scientists and the extension staff, to the farmer the two are the same, and hence when confronted with a problem farmers consult the extension staff, and extension staff exercise their own judgment.

The following account of groups working with the two research centers sampled in this study is organised in three main parts. First a diverse range of groups is described. Second, maize groups are explored. Finally attention is paid to the characteristics of some farmer-organised technology groups, with no formal links to the research process. This is intended to highlight some of the major contrasts between induced and spontaneous groups, with a view to pin-pointing the crucial importance of group selection procedures and how and why this may need to be broadened.

Diverse groups

The first part of this three part account tries to convey a sense of the range of groups working with the two case study centres. In each case membership and activities involving KARI and the ministry are described and discussed.

Embu Nembure group No. 1

This group started off as a focal area-based group, i.e. a group resulting from an attempt by the ministry of agriculture to organise farmers on the basis of watershed and catchment areas. Each watershed had between 300 to 400 farms and the intention was to conserve soil through terraces and other conservation structures following which crop production technologies would be introduced. The group consists of 20 members and was formed in year 2000 for soil conservation purposes. KARI selected this group for testing quality protein maize, Irish potatoes and Tethonia diversifolia green manure technology. Agrochemical companies have also been working with the group on their group farm. The group members pay a monthly fee of Ksh 20 (25 Eurocents) deposited in an account and used for various purposes agreed by the group. The members also generate some revenue from growing and selling potato tubers from their plot, and pool funds for purchase of inputs such as fertilizers and seeds. The group occasionally organises visits to other groups. This is an activity they learnt after research scientists and extension staff organised a number of visits for them. Some of the visits are made on foot while others require hired transport, for which they use their saved funds. They hold their meetings on Thursdays and agriculture extension workers occasionally attend these meetings.

The KARI project is well linked to other efforts of the ministry. While Tethonia was supposed to be used on maize only farmers tested it on sweet and Irish potatoes. The treatment works not only for fertility but also for insect control. The group has a charismatic leader and one of the members is a retired ministry of agriculture extension worker.

Embu Nembure group No. 2

The second group is a mixed group with a total of 40 active members. It was started in 2002 as a merry go round (rotational savings club), whereby an agreed amount of money is collected at each meeting and given to members in turn. The group then started engaging in agricultural activities and was involved in KARI participatory research activities in 2003. They were involved in testing of beans but they also bought seed potatoes which they managed with technical guidance from the research scientists. The group members make contributions to a savings and credit scheme operated by the Embu Catholic Diocese where members get some short term loans to buy inputs. The group holds meetings on every first Wednesday of the month and links with the social development wing of the Catholic Church. This arm of the church has a full time officer who takes care of church members social issues within a certain zone.

In 2004, the group came up with an idea of hosting a demonstration on its farm but had no funds to buy the seed inputs. They therefore decided to use their own local seed and planting materials that included beans, groundnuts, sunflower and local and improved potatoes. In the course of trying to get more materials to fill their garden they talked to the scientist in charge of sweet potato work at Embu centre who supplied them with some improved vines. An NGO called Farm Input Promotion Services (FIPS) gave them seeds and agrochemicals obtained from some

input supply companies after learning about the intended field day from an input stockist in Embu town. The field day hosted on the group plot (and attended by the present researcher) attracted a sizeable group of about 110 interested farmers in June 2004.

The group is presented to illustrate the fact that KARI is not the only entity working with groups in rural Kenya. From a farmer perspective, KARI activities may be a way of strengthening a portfolio of group activities, and researchers need to take account of how different elements in the portfolio might interact. For example, commercial promotion of agro-chemical inputs may clash with attempts to discover the effectiveness of green manure through experimental means. In this case the partnerships has been working well, with an exception of some conflict of interest occasioned by an overlap of visiting dates by different groups, a source of division among members at times. The groups' field demonstration was an impressive initiative, at first frowned upon by the extension staff. The group involved the local leaders and as a result of their commitment, the divisional extension officer, not at first keenly interested in the affairs of this group eventually became involved in this activity. When I interviewed the group on how the demonstration idea started, they informed me that discussions held with various people who came to view participatory activities and the field day they held with KARI officials gave them the idea of hosting their own demonstration and field day.

Embu mothers' group – group No. 3

This is a womens' group originally started as a merry-go round (as in the previous case). The group began in 1986 with 20 members, and later involved as many as 40 women. In 1989, funds were used to buy dairy cows for some members, and some more cows were then bought by an NGO for the group to allocate. Members contribute Ksh 150 per month and an additional Ksh 20 each for any member facing problems. They also penalize anybody who arrives late, interrupts meetings or fails to attend. These kinds of sanctions tend to unify groups by excluding both free riders but also the poorest members of the community, who often cannot afford time or regular contributions, e.g. due to lack of income or domestic help (Kiptot 2007). KARI worked with this group on establishment of sweet potatoes for tuber and vine production. The group was also trained on sweet potato value addition (e.g. storage and processing), soap and jam making, traditional food recipes, *maendeleo jikos* (energy saving fire places) and kitchen gardening by KARI in collaboration with the home economics unit of the ministry of agriculture. The ministry of health trained them on construction of VIP latrines (concrete slab floor pit latrines with a vent). The current merry-go-round activity is targeted on constructing a water tank for every member. Meetings are held on the 4th and 15th of every month.

A unique thing about this group is that starting from 2000 they adopted a strategy to recruit all newly wedded wives within their neighbourhood into the group. Before this is done, the new couple is approached by an appointed member and her spouse to seek their agreement on the membership of the wife. Once consent is given, the new member is provided with a heifer with which to 'start her herd'. This is bought

using the group's contribution, or a heifer is passed on from among the members who get paid what the group calls 'milk' 'money', i.e. money paid to compensate the calf owner for milk used in raising the calf. Consent is not always obtained as was explained by the chairperson of the group. Although the frequency of refused consents were not provided, it was made clear that some men and some in laws were not in favour of their wives and daughters in law joining this group. This was out of fear of potential 'bad influences' from some group members.

Once the new member joins, she is coached by the older members on how to participate in the group's activities and also how to take care of her home. The group plans to constitute a branch once it has a sizeable number of young newly weds, while older members will continue being mentors. The husbands - particularly those not working away from home - have also been approached with the possibility of forming their own group, which could then develop complementary activities.

Kakamega banana group No. 4

This is a mixed group of 30 members which started off as a farmer field school under the ministry of agriculture in February 2000. In 2001, KARI involved them in a tissue culture banana project which had three components. These were tissue culture of banana plantlets (TC), development of clean sucker planting material and field sanitation. Members were shown how to prepare nematode and weevil free planting materials from their local bananas and how to maintain clean fields. KARI scientists conducted a diagnosis with groups in the area in June 2000. The results were presented to members and stakeholders in the region. The farmers in the meeting selected 10 host farmers through picking papers in a hat to avoid bias and the ten lucky farmers received TC plantlets and weevil control materials.

The project consists of testing the performance of TC banana materials and also different banana nematode and weevil management practices on suckers obtained from old orchards. Practices include Mexican marigold planted in the orchards to repel nematodes, trapping of weevils using old pseudo stems, soil fertility management using mulch and farm yard manure, and field sanitation. The members plan to levy a small charge for every banana sold from the group and this is what will be used to buy TC banana planting material for the rest of the members of the group. Research scientists collect data from the banana plots on a fortnightly basis. The extension worker in the area is the group facilitator and visits the group on appointed days.

An interesting development in the group is a modification based on the banana stool population. Banana growing recommendations advocate three banana stems per stool to be the recommended agronomic practice. These consist of a bearing plant, a follower and a sword sucker. All other suckers are supposed to be continuously removed from the base and destroyed or fed to livestock. Owing to the nature of sucker sprouting, this is an activity that takes a lot of farmers' time. Added to this is the fact that TC bananas produce very big bunches, as well as having synchronised production, where 90 out of 100 plants may be in production at the same time. This

facilitates bulk marketing, which is a situation rarely experienced with traditional bananas. The big bunches and synchronised production endears the technology to many farmers. There is shortage of plantlets, and farmers who have attempted to grow suckers from established TC orchards (although this is discouraged by scientists' recommendations) have observed good performance. The demand for planting material hence tempts farmers to have more than three suckers per stool. The clean material preparation aspect links well with this need in the community. The group therefore has a problem with the destruction of the young sword suckers since according to a member of the group:

> *Denying planting material or seed to a neighbour is taboo since you might find yourself in a similar situation next season… in any case, we have been establishing bananas using old suckers for our traditional bananas all these years and our bananas are still going strong.*

The research scientist has a different view of the same situation, and claims that farmers are simply not ready to pay money for new technologies, and that the departure from recommendation is simply an excuse not to part with money. In the meantime the group has conducted its own tests and they insist that - as long as the banana suckers are 'pared' of all roots and exposed dipped in hot steaming water to kill weevils and nematodes – they perform as well as the mother plants. Studies have been initiated in a different research centre to test the effect of replanting suckers from old mother plants. The group has its meetings on first Friday of each month.

Kakamega Muntu Group No. 5

The group started in 1997 after a PRA in which resource flow mapping was undertaken. Farmers were divided into three categories based on their soil management capacity. Category one comprised those with practices classed as good, category two was those classed as fair and category three those classed as poor. Throughout the process, farmers in categories two and three were urged to ensure that they moved to a higher position than the starting one. It was realised that the most severe problem was soil erosion. The group was shown how to lay out soil conservation structures and afterwards, beans, Napier and new maize varieties and compost were tested in various host farmer plots.

The farms are on steep hillsides and soil erosion is indeed serious. PRA established that soil erosion was understood as an immediate problem. But despite efforts by the soil conservation division of the Ministry to assist farmers to conserve soil, local perceptions hindered the effort because, as one farmer interviewed in 2004 reported:

> *We believed that plot sizes which were already [too] small would be reduced further by the conservation of conservation structures.*

However a *fanya juu* terrace (a terrace with soil put on one side) demonstration undertaken by researchers and ministry of agriculture staff on one farm changed the above perception. The soil put on the upper side of the terrace had to be stabilised using Napier grass. This to the farmers was like creating new land rather than reducing it, as in the initial perception. The soil conservation practice was thus

accepted, and KARI then engaged the farmers in participatory testing of rot resistant beans, Napier Grass and compost. The rot resistant beans were black in colour, which was not acceptable to farmers. However some farmers found a market for the beans, and henceforth the beans were grown for sale. Other beans - like small red haricot and rosecoco beans - were then introduced and finally the most acceptable ones were identified. This is an example of a flexible participatory intervention, with a diversity of intervention activities, where farmers' needs and interests were addressed with some degree of success.

Maize research groups

Maize is not a traditional African crop but was introduced by the Portuguese in the sixteenth century and several centuries passed before it became fully established as an important staple crop in East Africa (Miracle 1966). Mango and Hebinck (2004) identified four main maize introduction networks into Luoland Kenya, and similar networks seem likely in many other maize growing areas of Kenya. These include Portuguese traders, food and famine relief, labour migration and maize research programmes. Some form of maize research work in Kenya stretches as far back as the 1920s, but the most remarkable research work was that conducted in the mid-1950s at the urging of large-scale European farmers. The colonial government, with the assistance of the Rockefeller Foundation, then hired a maize breeder, Michael Harrison, to work at the Kitale Research Station. His early work with local varieties resulted in meagre yield increases, but a 1959 germplasm collection trip to Mexico resulted in a different and more favourable turn in his maize research work. In experiments involving some 200 lines, he crossed an Ecuadorian line with the best local variety, Kitale Synthetic 11, upon which the resulting hybrid (H611) gave a remarkable 40% increase in yield. This hybrid proved appropriate to the high potential areas of Kenya, with their fertile soils, abundant rainfall and moderate temperatures (Harrison 1970, Gerhart 1975, USAID 1980, Blackie 1989, Karanja 1990, Mango and Hebinck 2004).

An assumption then was that the hybrid was not for the African smallholder farmers, since they would be more comfortable with the local synthetics due to the wider genetic base, thus reducing the chances of crop failure. Moreover, being an open pollinated variety (OPV) buying of new seed each year was not necessary, as was the case with the hybrid seed. Contrary to this assumption, however, smallholder farmers demanded and purchased the hybrid seed, which became so popular that by 1977 small-scale farmer hybrid maize production had surpassed large farmer output (Karanja 1990).

Since this initial success, the research system continued breeding and releasing new maize hybrids and OPVs so that by the mid 1970s ten hybrid maize varieties and three OPVs (composites) had been released (Hassan et al. 1998). Maize yields grew at an average rate of 7.1% annually over the period 1963-91, but a significant levelling off in the rate of increase was observed after the 1970s even though adoption levels for small-scale farmers - which stood at 16% in 1974 – had advanced to 58% by 1984

(Hassan et al. 1998). According to studies conducted since that time, adoption of hybrids has been variable and region specific, but on the whole a low adoption trend and corresponding low yield levels have become apparent (Maredia et al. 2000, Hassan et al. 1998). The current national maize production stands at 23 million bags while consumption is over 30 million bags with over 60% of this production coming form the smallholder farmers. Being a staple cereal, a seven million bag shortfall has to be externally sourced, whether as normal imports or as food aid. As reported in Chapter 1, estimates suggest it might be possible to increase production by up to 11 million bags, if proper agronomic practices are used to mitigate production constraints in the various regions. Involvement of the farmers who are the users of these practices is critical and hence the reason behind the engagement of farmer research groups in development and adaptation of maize technologies. The four cases documented here illustrate various aspects of such operations by research scientists and the nature of the interaction with farmer groups. The groups include those testing weed management by fertility enhancing activity, adoption of green manure legumes, insect management by the 'push-pull' method, and adoption of quality protein maize.

Maize conservation tillage by fertility trial – to conserve or to feed?

Work with this group emanated from a focused diagnosis which revealed that key factors limiting maize production were seeds, soil fertility, fertilizer availability and labour constraints (land preparation and subsequent weeding). The research scientists had tested conservation tillage methods on station and found that this could reduce labour requirements in maize production and improve crop yields. It is on this basis that research activity aimed at testing different conservation tillage and fertilisation practices with the farmers was designed. Two different tillage levels (conservation and conventional), two levels of weed management, and two levels of soil fertility were tested. The objective was to jointly test the performance of maize under these management practices. Five groups were involved in this research, spread out over three administrative districts. The expected output was that integrated crop management practices would be tested and validated under smallholder conditions. It was also expected that socio-economic factors limiting adoption of conservation tillage would be identified and addressed and information packages on integrated crop management made available to farmers in the area. At the end of the season, farmers were trained on management, and assessment methods and a field day was held. Results of the work showed that farmers could save 50% in labour costs through minimum tillage and improve crop yields by 30%, while use of fertiliser would improve crop yields by 50%.

From own observations and interviews with farmers, various modifications were made by the farmers to the practices introduced by the research scientists. Such modifications included spot application of herbicides for the difficult weeds in the conventional (hand-hoed) tilled plots, mixing of fertilizers with farmyard manure and feeding of livestock with maize stover and residues meant for conservation, (minimum) tillage processes like mulching and organic matter accumulation. Some of these practices contravened the research scientist recommendations.

Green manure legume fertility trial – are the leaves red or purple?

In the diagnosis referred to in Chapter 4, low soil nutrient status was identified as a limiting factor in maize production. Inorganic nutrient sources are expensive to obtain and hence locally available materials were proposed (but contested in a CRAC meeting – see ch. 4) as a suitable alternative. Trials were set up with farmer groups, where five different green manure legume options were tested together with biomass transfer (Tethonia), cattle manure and inorganic fertilizers, and compared with a non-fertilized control plot. Five farmer research groups located in different sites were involved in this research. The group farms were strategically located to allow non-group farmers to view the treatments for evaluation purposes and a field day was held at the vegetative stage when maize plant vigour and leaf colour clearly exhibit nutrient status. The field day was held on the same day for the five sites.

Farmers from the respective five groups were collected from their respective sites and transported to the field day and evaluation sites. A total of 180 farmers attended these occasions. Following prayers, and introductions, a research scientist gave an overview of the evaluation process. Attributes to be evaluated were described. These were plant height, plant vigour, leaf colour, stem strength, cob size and others. As the research scientist tried to describe the leaf colours to be assessed, an argument broke out, with some farmers saying that they had never seen red maize leaves, while others said they had seen purple and other shades. A further argument focused on plant vigour and stalk strength, since in the local language these two aspects are described using same word. These arguments both reflected translation problems (colour categories are notoriously slippery concepts, and hard to translate, since some languages restrict themselves to three basic terms – white, black and red). The scientist had to harmonise local categorisations in order both to facilitate discussion and to ensure uniform data collection for statistical analysis.

Every group then selected a team of five members to form the core evaluation team. This core team was provided with sheets of paper on which to score various aspects for both maize and the green manure legumes. A literate person was included in each group. I followed one team round all the plots in the trial. A lot of consultation was observed among the team members and between team members and a guide (a research assistant) on hand to help with the particularly difficult cases. The farmers had a problem with the scoring of manure legumes, where the variables were ground cover, vigour, etc. They wondered why a legume with a dense cover is considered better than the one with less cover since in their opinion there is likely to be more competition in the former case. This is a simple example of the way in which the 'pre-cooked' categories of scientific research need to be re-formulated to grasp issues of importance to farmers. Classification, as anthropologists have long argued, is not based on absolute and objective categorisations, but is a product of a practical context, and one in which (moreover) the 'classification of things reflects the classification of people'. (Douglas 1976).

After the farmers were through with evaluating one site they were taken to the next site and the same process was repeated. After the teams were through with the scoring, other farmers - not members of the farmer groups - arrived for the field day. I was later informed that the area extension officers had publicised this occasion so that farmers could come and view the new and inexpensive 'fertilizer' source and proper maize crop management practices.

I followed two groups throughout as they viewed the plots. Their questions were varied and included such as:

Q. Are mucuna seeds edible? – [A.. No]
Q. Why does farmer's maize look better than the plots?
A: the plots include both good and poor treatments for test
Q. Can one use furrows instead of holes for maize planting?
A. Yes but they involve more labour
Q. Can I mix fertilizer and manure?
A. Yes
Q. Are these different maize varieties?
A. Yes
Q. Was all the maize planted on the same day?
A; Yes
Q. What is wrong with DAP (Di-ammonium phosphate)?
A; Nothing really but over time it increases (ururu) 'bitterness' of the soil (Ph level) with bitterness being the word close to being acidic
Q. Which is the best of all these plots you are showing us?
A; You tell us…..which would you prefer?

A follow-up done later in farmers fields indicated that selection of technologies was variable between the farmers, with a majority opting for combined organic and inorganic sources of nutrients. Others combined Tethonia and cattle manure, either as a direct application or indirectly through using Tethonia as bedding in the cow sheds. There was a problem of competition between shrub legumes and food crops which tended to discourage use of the shrubs. Farmers tried these treatments in small plots of 0.02 to 0.05 acres which the research scientists hoped was with a view to confirming the performance and then adopting them. It however was confirmed by some farmers that there was lack of adequate plant biomass, as well as land, and hence the small plots were what the farmers could afford. Financial resources for purchase of hybrid maize and inorganic fertilizer were also a challenge. The research scientists agreed that while recommendations are assumed to be final, there is need to follow up to establish what happens, and possibly this might then lead to the ploughing back of useful lessons or ideas to be tested in further trials.

The 'push- pull' strategy for maize borer control- repelling insects or hunger?

Insect pests were ranked as a problem in the diagnosis surveys. Stalk borers are a serious pest and purchase of pesticides is difficult for many farmers. Tests done on-station revealed possibilities of using silverleaf desmodium (*Desmodium uncinatum*) a fodder legume, and Napier Grass (*Penissetum purpureum*) to repel and attract stalk borers from maize. This technology (referred to as 'push-pull') consists of various

rows of Desmodium planted in the midst of maize rows and Napier Grass surrounding the plot. Advance planting of Desmodium and Napier Grass is done so that they are both well established before maize planting. According to on-station findings maize stem borers are repelled from the maize by Desmodium and are attracted by the Napier Grass on which they lay their eggs.

The work involves ten farmer groups, scattered across the district, working with scientists. Maize is planted at the normal spacing of 75 x 50 cm and Desmodium planted between the rows. The plots are surrounded with four rows of Napier Grass, and the idea is for borers to be attracted by maize (pulled)repelled by Desmodium (pushed) and then finally attracted on to the Napier grass (pulled). Upon hatching, the first instar larvae try to burrow into the Napier stems but get stuck in the plant's sticky sap. Groups planted the materials as advised, and at the onset of the rains maize was planted.

On a specified day the ten groups were asked to gather in one of the farm research group sites (a group plot at Mzee Kinyua's farm) where the maize is at the vegetative stage and the Desmodium plants are flowering. The group members, as well as non-group on-lookers, gather at the site, starting from 10 o'clock. After prayers, the farmers are provided with notebooks and leaflets about the technology and they move around the plots asking questions. The research scientists use an approach where they ask the farmers to state their take on various aspects of the crop, upon which the research scientists record it.

At the end of the plot visits, the farmers make a final stop at a display that at first looks a bit removed from the happenings in the maize plot. This stop is at Mzee Kinyua's cow shed, where the livestock extension officers have decided to add more displays to the maize field day, and use his livestock to demonstrate good livestock management practices.

During the field day, it was observed that farmers were very keen on the plot due to its luxurious performance. However, Napier Grass and Desmodium, which are also animal feeds, attracted more questions than the insect treatment effects. Hence questions included how often to cut Napier Grass or Desmodium, and whether too much Desmodium is harmful to the cows. It was also apparent that another pest (cutworm) was a problem on maize, and questions about it were asked frequently. This also applied to streak which affects the maize, especially during the short rainy season when stalk borers are also rampant.

Results showed that two or three rows of Desmodium in maize rows was effective. The maize appeared relatively clean, but in the opinion of the farmers interviewed, the right season to conduct such a trial is during the short rains. This is because during the long rains the effect of stalk borer is minimal. In one farmer's words:

> *Nearly all maize leaves in a field take on the appearance of sieves due to the damage holes on them during the short rains... in fact many of us have stopped planting maize in the short rains due to severe infestation of these insects.*

Further discussions with farmers revealed that they were attracted to this technology because they noticed that all the farmers practicing it take a lot of milk to the dairy. On investigating, they found that it was because of feeding the milking animals on Desmodium. This has led to integration of livestock and food crops by the farmers, and therefore even farmers who are not in these groups are now practicing the technology, but to address 'animal hunger' not to repel insects.

A group of 15 non-group farmers expressed a wish to form a new farmer research group. One farmer was overheard teasing another:

> *If the things we were taught today are the ones you have been enjoying, we also want to enjoy.*

An interesting observation with these research groups was their group nurseries. For every group there is a nursery where at the beginning of the trials, Desmodium seeds were established. After experiencing a lot of problems with the method of seedling establishment introduced by the research scientist (and also with the high cost of Desmodium seeds, at Ksh 1200/kg. (15 Euros) farmers decided to try out a new establishment method. This arose out of the farmers' observation that Desmodium runners, when buried under soil in the course of weeding, developed roots at the nodal regions. The farmers therefore decided to pick these rooted segments and try them out to expand their stands. This proved successful, and since then the innovation has spread throughout the whole area. This innovation – modelled on experience with sweet potato and fodder grass establishment - has in the context of this project been combined with establishment in polythene bags supplied by the project.

Certain comments by the extension officer are also worthy of note. The comments revolved around the fact that farmers '*have been very passive in the past but have changed drastically of late*'. This remark was prompted by a question to the staff on what has changed, or remained the same, in her work since the project started. When I asked her to substantiate, she gave me an example of how group members have been calling her on her mobile phone, to ask questions on various issues to do with information not only from KARI but from other agriculture sector players:

> *I sometimes have a problem since the calls come at all hours, whether day or night.*

It is therefore clear here that participatory research forms a basis for dialogue, and mobile telephones are tools that could perhaps be utilised much more in future to facilitate such dialogue, and perhaps even to change the face of information flow during the process of participation.

Quality protein maize (QPM) - sweet or good?

KARI research scientists are testing quality protein maize sourced from CIMMYT's QPM project in Wambugu farmers' training centre. It is located on the side of a busy road heading to the headquarters of central province, Nyeri. Farmers are invited from various divisions of Nyeri district for an open day. Some of these farmers have jointly worked with the research scientists in various projects back in their home

localities. Others have been invited by the extension officers, and hence are not necessarily doing any joint work with research scientists.

The demonstrations are many, ranging from tissue culture bananas, improved cassava, dual purpose goats and the quality protein maize. Farmers walk through the various demonstrations and research scientists and extension officers explain the various technologies. Tasting takes place at the last stage. Maize cobs have been boiled and put into different trays and labelled ABCDEF. The farmers are supposed to taste half a cob and then record on a form whether sample A is a) very sweet, b) sweet, c) not sweet, B…, and so forth.

Everything goes well until the research scientist tries to explain what the word 'sweet' means, because the farmers have a different notion about 'sweetness', signifying the appropriate 'goodness' or 'suitability' that they look for when eating boiled maize. This comes out when the first few farmers taste the cobs and express satisfaction with a 'non sweet variety'. It emerges a 'sweet' cob is taken to be too young for boiling! According to the research scientists, QPMs are literally sweet (i.e. have a high sugar content). They are not aware of the farmers' meaning. The farmers then took the research scientists to task on whether every 'sweet tasting maize' had a high protein content. The research scientist answered that it was not necessarily so, but later admitted to me that it was a question he had not thought about thoroughly.

Discussion of the cases

The four maize cases above are selected to illustrate the various methods that the research scientists use to interface with the farmers. In the first case, farmers are explicitly invited for a field day but implicitly invited to evaluate plots. The approach has a shortcoming, in that while farmers arrive at such venues with expectations of learning about the technology they are deviated from that idea. They depict this through the questions they ask. These are mostly general questions to do with the technology, but often opening up different dimensions to those pursued by researchers. The other problem is evident when research scientists restrict themselves only to those attributes that they know about. There is no clear sense that questions they cannot answer raise important issues about which to think, and it is thus very easy to discriminate against aspects that have clear significance for the farmers.

In the second case, the farmers were taken through the plots and also exposed to other technologies. The livestock demonstration was particularly appealing because it tied in very well with the Desmodium and Napier Grass issue. After the season was over farmers used the material from the plot to feed their livestock. Including the livestock demonstration therefore suited the occasion, and also changed the meaning of the event, away from insect control. It opened up an adoption pathway meeting the needs and ambitions of the extensionists, but pity the poor insect researchers who had much less to take back to the research station or publish.

In the third and fourth case, assessment (particularly in the third case) had its own problems. These were related to the stage when the maize was evaluated. It was a bit late and also there was a misunderstanding between the criteria used by farmers and that used by the research scientists.

In all cases where farmers fill out forms, these are in English, and the literacy requirement excludes some farmers. In fact on a different occasion the research scientists went to the extent of asking those who can read and write to identify themselves and move to the left, and those who cannot to move to the right, out of which the core groups were selected. This created a very awkward environment for the evaluation process, because many farmers saw it as being judgmental, which risked answers designed to impress.

Besides the groups so far described the research for this thesis also looked at some self-organised. The two cases to be described below were of rice farmer and cultivators of a narcotic, *khat* (*Catha edulis*) much of which is exported to Somalia. These self-organised activities indicate that farmers do indeed search out technological answers, even where there is no link with government research, but that the activity is often organised somewhat differently. At issue is whether participatory research involving formally-trained scientists can learn any lessons from the self-organised sector.

4. Self-organised farmer technology groups

Owing to the opening up of political space and the structural adjustment programmes in Kenya since 1992, changes have swept through various sectors, and agriculture is no exception. Farmers have therefore found room for manoeuvre, and often involve themselves in new initiatives and activities unimaginable in earlier decades. As described by Arce and Long (2000), farmers exhibit a development counter-tendency that leads to their own localised agro-technical recommendations. This is the focus of the farmer organised initiatives captured in this section. Viewed from the context of participatory technology development, counter-tendencies provide vital lessons for participatory research practitioners. Participatory technology development has so far been viewed as a practice where research scientists emphasise 'non social' elements (i.e. technical recommendations) at the expense of 'social' or 'institutional' aspects of agricultural practice. A major insight from the two self-organised cases to be discussed is that the two elements have to be combined to be applicable to the farming environments. The final form that technical practices take is the result of interactions between technologists (in this case farmers) and the social environment within which they are embedded. The cases bring out a range of findings about local innovations and accompanying necessary adaptations, and the knowledge and information exchange that then takes place to ensure a spontaneous spread (out-scaling) of effective innovations.

Case 1: *Jua kali* rice - self mobilisation in the swamps

Setting

Jua kali rice is the name given to rice farming beyond the formal limits of the major Mwea irrigation scheme. Before rice found its way into *jua kali* fields the valley wetlands bordering the scheme were uncultivated, and full of reeds and other water plants. As mentioned above, no rice was supposed to be grown outside the demarcated 6000 acres of the Mwea rice irrigation scheme (MRIS) (Lees 1986, Ruigu 1988, Nguyo et al. 2002, Kabutha and Muteero 2002). This was out of concern that the growing of rice outside the scheme would interfere with supply of water to the scheme, but at the same time it was felt that performance of the rice outside the demarcated scheme would be poor in any case, and thus a waste of time and resources. It was therefore not surprising for new farmers, outside the scheme, when regulation was first relaxed, to be confronted by a problem the moment they started diverting water into their plots. The water bailiffs working with the now 'powerless' National Irrigation Board confronted farmers seeking to know why they were breaking the law. Constant confrontations saw farmers coming together in different parts of the *jua kali* section to form small 'groups' to deal with this problem of official harassment. These groups would hold their meeting very early in the mornings, so that by the time the water officials came calling, they would have a common approach to the problem. The approach worked, and these groups continued to function, and indeed increased in size as more farmers kept on opening new plots for rice cultivation. The group meetings in the mornings continued even after the threat from the water officials lessened. They were eventually converted into 'experience exchange groups' where cultivation issues would be discussed. The account of rice cultural practices by the *jua kali* cultivators described is followed by a discussion of the whole process.

Background

Cultivation of *jua kali* (hereinafter JK) resulted from a farmer rebellion in the Mwea rice irrigation scheme (MRIS) that led to a whittling down of authority of the National Irrigation Board (NIB) over the scheme. The MRIS, established in 1954, had the aim to rehabilitate and resettle ex-detainees of Kenya's freedom struggle from various detention camps, and by 1958 the scheme went into production (Lees 1986, Nguyo 2002). As Chambers (1973a) argued, the political goal of defusing the rebellion by gainful employment of the disaffected had given way to the less narrow objective of economic development through increased productivity. Each ex-detainee was to grow rice on 1.6 ha of land, and any other agricultural activity had to be done with the manager's authority. As described in Veen (1973), a militaristic style of organisation characterised the Mwea scheme, where rigid supervisory positions were hierarchically stratified. All the harvested rice was supposed to be delivered to the board's stores, upon which farmers were allocated 12 bags per annum to cater for domestic needs. The Board marketed the rest and paid the proceeds to the farmers, minus costs and services provided (GOK 1966, 1977). Payment of these proceeds was often delayed, and farmers' services were over-priced (Wangui 2000). Chambers (1973b) points out that the tenant was at the bottom of the hierarchy, the object of supervision, and required to deliver rice as a condition of the tenancy. In 1998/1999

farmers refused to deliver the season's rice harvests, and organised demonstrations and riots, at the end of which farmers were no longer answerable to the Board (Daily Nation 2000).

In a report from January 1998 in the *Sunday Nation* entitled 'Mwea: farmers or serfs?', a correspondent detailed:

> *For three days the sprawling irrigation scheme was virtually occupied by a combination of the paramilitary General Service Unit (GSU) and the regular police, who loomed over the scheme impounding rice and delivering it to the NIB... at Karaba, the Sunday Nation witnessed a man carrying the remnants of what was once his bicycle after the police were through with it. (Sunday Nation Jan 1998)*

Following the skirmishes in the scheme, farmers neighbouring the MRIS in Ndia Division of Kirinyaga District, with no previous rice growing experience, started growing rice on river valleys in their farms in 1999. This cultivation was then illegal, according to the board's regulations, owing to the risk of interference with feeder streams to the canals supplying the rice scheme. This marked the onset of informal cultivation of rice - also called '*jua kali*' (JK) - necessarily without extension or research services support due to its illegal nature.

The information and organisation systems that developed as farmers struggled with rice cultural practices were as interesting as they were challenging. In one farmer's words:

> *It is a battle in the swamps which we have to win at all costs.* (interview 2004)

The nature of this battle is apparent in the events and results described below, where farmers (in their words) managed to change their status from a situation of '*surviving*' to one of '*thriving*'. The thriving followed a period of trial and error with various rice cultivation practices, involving various experiments leading to farmer innovations in variety selection, seed selection and pre-germination.

Varieties, seed selection and pre-germination

Five different types of rice were obtained by farmers from the MRIS. These were Tall-B (Bw196), Small B (IR2793), Pakistan (jasmine), Pishori (Basmati) and KAITA (IITA selection). After growing these varieties for a number of seasons, farmers observed that short B (IR 2793) performs very well as long as fertility remains high but deteriorates as fertility declines, while Sindano or tall B (BW196) and Basmati continue to perform well even under conditions of low fertility.

> *We grew small B for two seasons but it disappointed us since it started turning yellow and gave us very poor yields. Tall B has no problem. If you are opening new land, which normally is high in fertility, you can grow this small B, but you have to change after a season or two* (farmer interview 2004)

The performance of small B was confirmed by a majority of the farmers, and on checking with the rice agronomist, it was discovered that IR 2739 is sensitive to low fertility, which is not the case with Sindano (Bw196) and Pishori. However some farmers in areas with soils of high fertility continued growing short B due to its

superior yields. Aware of performance differentials, as soil conditions varied, farmers were always on the look out for any new introductions by their neighbors, as indicated in the following statement:

> *A farmer across the road over there has tried this new variety called 'Kaita' and she harvested good yields last season. We want to see how it will perform this season and next season we shall plant it.* (farmer interview 2004)

Farmers select their own seeds at harvest, or buy seedlings from neighbours who have an excess in their nurseries. Subsequently, some farmers have started nursery establishment and sale of seedlings as a business. They establish different varieties to suit different preferences.

Three seed selection methods are used by farmers. One is identifying an area in the field with healthy looking plants, where plants are separately harvested and threshed for seed. The second method involves vigorous shaking of all heads upon harvesting and the kernels that fall off first are stored separately from the rest to be used as seed. The third method involves separate harvesting and threshing of large sheaves from the general field. The seeds obtained from these different methods are not planted in the next season but are stored for one season, to be planted in the second season. Some farmers believe that the longer you store your seeds, and hence the older they are, the better they will perform.

On checking, the rice agronomist again confirmed that some but not all varieties have a dormancy period and require to be stored for a season. Farmers store all of their varieties, however.

Before seeds are planted in the nursery, farmers pre-germinate them using three different methods. The first method involves a 'hole and fire'. This involves soaking seeds in water, packing them in a sisal bag and burying them in a hole on top of which a fire is lit to provide warmth. The hole is uncovered on the second day and the bag turned to allow for even germination.

The second method is the 'manure heap method', where seeds are put in sealed bags and buried in manure heaps for three days. A third method involves covering of bags of seed under rice straw heaps for two days. Farmers indicated that they alternate between these practices, based on their experiences with each. At the end of the different periods, the rice is ready for planting in the nursery.

According to interviews with former rice extension agents, pre-germination is supposed to be done by soaking seeds in water for 24 hours and then covering with rice straw for another 48 hours. The temperature in the rice straw is adequate for germination. According to a farmer using the hole and fire method:

> *Covering the rice in the hole and lighting a fire above it gives me very good germination results. I have also tried covering with rice straw but it took longer to germinate.* (farmer interview 2004)

Some farmers have learnt the pre-germination practice by participating in the different steps with farmers who have earlier experience with the methods.

Nursery preparation, planting and transplanting

Nursery preparation involves identification of a nursery site, which in most cases is one corner of the rice plot. The size of the nursery varies, depending on the available land for transplanting. The site is dug into a fine tilth and when available goat manure is applied. This may be mixed with chicken manure and ashes. Fertilizers are not used in the nursery because of the belief that the seedlings will be scorched by it. One farmer said cow manure is also not used because*:*

> *The seedlings require to feed on soft manure while cow manure is tough for them.* (farmer interviews 2004)

Other farmers expressed the view that cow manure does not break down into fine particles easily and this makes the nursery rough and hence farmers avoid it. Ash is added to the manure to kill any insects in the soil, according to farmer opinion.

The mixture is then incorporated into the nursery and the seeds are spread out on the surface and covered with dry vegetation. The nursery area is dependent on the amount of seed, as narrated by a former rice scheme casual worker turned 'jua kali' rice farmer. Thus:

> *When rice is squeezed closely together, tillering is suppressed and subsequently the rate of growth is lower*. (farmer interviews 2004)

The farmers scatter the seeds in the nursery from where seedlings are transplanted after a month. Land for transplanting is dug by hand and may later be harrowed using ox-plough or by hand. The land is prepared in plots measuring ten by ten steps (C. 10 x 10 m.) referred to as *kipande* (piece). This is the unit of measure in these rice fields. Farmers will therefore talk about the seeds, labour, bags and fertilizer per *kipande*. The plots are then irrigated and transplanting is done.

This is an activity that newer farmers have to learn from experienced farmers. They acquired this knowledge either through hiring experienced labourers or by offering their labour as 'participant observers' on the farmers of the more experienced. While either men or women can do the transplanting, field observations showed more women doing transplanting.

Fertilisation, pest control and weeding

Di-ammonium Phosphate (DAP) fertilizer is applied by some farmers after transplanting, while others apply Urea. Some farmers scatter trash in the field or apply manure in the season preceding the rice planting. The quantities applied are based on the number of pieces, with every piece receiving a kilogramme of fertilizer (giving a rate of 100 kg per ha). To learn how to apply the manure, some farmers stated that they offered to help in application of manure and fertilizer on their neighbours' plots, and hence learnt how to do it for themselves. This approach also applied to pesticides.

The farmers mentioned several pests of rice, with the major ones being leaf cutters and stalk borers. The leaf cutters indicate their presence through the many leaf pieces seen floating on the water. This is the symptom that farmers take as their cue to start spraying with various pesticides. According to some farmers:

> *Use of pesticides has also led to elimination of many water borne insects which we see floating on water after every spray. As a result we do not suffer insect bites when our legs are immersed in water like used to happen before. (farmer interviews 2004)*

Weeding

This is an operation that calls for close supervision, especially when one is using hired labour. If not closely supervised, the labourers trample the weeds in, and re-growth occurs soon thereafter, due to the moist conditions in the field. Weeding involves removing the weeds and placing them on the raised banks. Sometimes weeds are buried in the mud, in what farmers call *gutobokia (*to push into ground).

Various weed types are encountered but a difficult weed appeared at the beginning of 2000. This was a small reddish plant that farmers saw floating on the water surface in their rice plots. They did not pay much attention to it but soon, dense weed mats formed on the water surface and any rice that was submerged in the water was choked by the new invader. Farmers' efforts to remove it were thwarted by the rapid growth of the weed:

> *When we saw the weed covering the fields we spent endless hours sweeping the weed with pieces of timber from the plots but a few days later we would find new clumps of weeds and soon the situation would be like we found it on the first day. (farmer interview 2004)*

The farmers named the new weed 'rice AIDS' (*ka-ukimwi ka mucere*) due to its damage manifestation (rice seedlings that were attacked looked emaciated). Farmers also tried to bury it in the mud hoping to drown it like the other weeds but more would resurface. The farmers also noticed healthy growth of the rice crop growing on such spots where weeds were buried. Some farmers also noticed healthy arrowroots growing, where the decomposing weed was heaped. Following from this observation, the farmers started making compost for application to kales with favourable results. Samples of the weed collected and taken for analysis by the researcher (Box?? and Annex 1) showed it to contain high levels of nitrogen and potassium. It was identified as Azolla sp. Ventura and Watanabe (1993) report that under optimal conditions Azolla doubles in biomass every 3 to 5 days, and one crop can be expected to accumulate between 70 and 110 kg N ha-1.

The farmers then noticed that the Azolla remaining below the rice plants in the water did not interfere with the crop. This brought them to the discovery that by controlling water level at transplanting time, the weed could co-exist with the rice seedlings with no adverse effect on yields. At one time, farmers experienced a water problem and rice grown in fields with dense mats of this new weed survived and produced a good rice crop. They therefore discovered that Azolla conserves moisture.

Some farmers also noticed that doves and other birds congregate in the fields where a lot of this weed grows, and '*we see them pecking on the dry pieces of this weed*'. On asking the farmers whether they think chicken can eat the weed one of them replied:

> *I am not sure if chicken can feed on the new plant but I will offer a little to my ducks to see if they will eat it.* (interview 2004)

Researcher reactions to the new invader

When weed samples were taken to the laboratory for the purposes of this study, the analyst supplied this report:

> *That the weed was a heavy feeder of "Nitrogen and phosphorous" and hence was competing for these nutrients with the crops but not for calcium and magnesium which was adequate for all samples* (lab report)

This fitted with the conventional view of weeds, based on the amounts of nutrients in the samples. The accumulation of these essential plant nutrients in a plant specimen would only mean one thing, and according to the analyst that was immense competition with rice.

It is also worth noting that while the JK farmers were struggling with the new weed species, a weed scientist who saw the weed in the Mwea rice scheme decided to test some herbicides for its control.

The experiment started on-station, where the experimental field was hand-prepared at the research farm, September 2001, and eight treatments replicated four times were set up in a Randomized Complete Block Design. The plot was inoculated with Azolla by hand and five herbicide treatments were applied while a hand weeded plot, a weed free and a weedy check were also included. Data on Percent Weed Control (PCW), Percent Crop Damage (PCD) were collected where PWC data were collected 10, 28, 39 and 68 days after treatment applications while PCD was based on a visual scale of 0–100 (where 0 = no control and 100 = complete control of the weed). Rice yields were assessed from all the treatments. It was observed from this trial that the weed increased in numbers in the treatments apart from two of the herbicide treated plots where control was better. The conclusion from this research was that:

> *For a herbicide with no residue effect the weed re-invades the field very fast but low re-invasion is observed in those with some residue effect.*

This effort was rendered futile by the rapid weed re-growth, not to mention the complexity and inaccessibility of herbicide technology among resource-poor farmers who had already lost support from the irrigation board (unpublished technical report, Mwea NFRC 2002).

In fact, Azolla spp. (a type of water fern) fixes atmospheric N, due to symbiosis with a cyanobacterium, (*Anabaena azollae*) and has been advocated as an effective green manure in rice farming (Wikipedia entry on Azolla). Farmers in the jua kali areas of the Mwea rice scheme seem to be well on their way towards identifying a number of this water fern's useful properties. In this, they are apparently more innovative in their thinking than some Kenyan researchers.

Harvesting and marketing
Harvesting takes place three to four months after transplanting, depending on the specific variety. The rice is slashed and tied into bunches. These bunches are then threshed by hitting them on the ground and the paddy collected into bags. According to the farmers, those who grow short varieties have a more difficult time, because they have to hit the rice sheaves with sticks, unlike the tall varieties where sticks are unnecessary.

After the crop is threshed, it is marketed through middlemen or traders in the Kagio shopping centre, on the road from Embu to Nairobi. This centre – and its rice processing and merchandising activities – have grown enormously since the Mwea scheme was de-regulated. Scheme settlers and *jua kali* cultivators both use its facilities. Depending on the farmer's financial position at the beginning of the season, sale of the crop may take place at the vegetative stage or earlier, in a contract arrangement of some sorts. This is an arrangement where the farmer enters into an agreement with the broker. The broker advances the farmer money, using the crop in the field as collateral. On harvesting, the broker collects rice to the value of his money (but at the price prevailing when the deal was struck) and the farmer is left with the rest. If the price rises unexpectedly then it is the dealer who gains the windfall and not the farmer. Out of the interviewed farmers, 45% were found to have entered into agreement with brokers in the last three seasons while 35% sold their rice to traders in the market and 15% kept their rice and waited for the crop to appreciate in price.

Rice fodder and mulch
Interviews with a rice breeder condemned the farmers poor yields brought about by poor agronomic practices and poor variety selection. The farmers, however, have a different assessment, because their 'poor yielding' rice also supplies fodder to improve livestock nutrition. According to interviewed farmers, rice in the vegetative stages is very good fodder for animals. This was confirmed by animal nutrition research scientists in Embu centre who explained the reason to be the abundant proteins and other nutrients at this stage of crop growth (research scientist interview 2004). Farmers from outside the JK rice growing area have also been buying rice straw to use as fodder for their animals. This started with the introduction of JK rice, since in the MRIS no straw was supposed to be removed from the fields but would be set on fire to burn out the seasons' pests.

Some farmers were found to be using rice ratoons as new kind of fodder crop – a very useful supplement during the dry season. Not all varieties ratoon equally well, and it will be interesting to see if ratooning is taken on board by researchers, when screening varieties for farmers adjacent to the scheme. The straw after rice harvesting is also a good fodder, used both in the JK area and outside. This (according to farmers) has resulted in increased milk yields and improved body condition of animals:

> *I let my cow loose to feed on the rice stubbles that had started sprouting after I harvested my main crop. I am now facing a problem because I wanted to dry off the cow and there is a two litre increase in milk production and the body condition is so*

good. I now have learnt that rice plants are nutritious as cattle feed. (farmer interview 2004)

The farmers in JK area also grow French beans and various types of vegetables. Mulching, using rice straw, by 35% of these farmers reduced irrigation frequency of horticultural crops from four to two days per week, a great increase in water use efficiency.

Information sources

Table 1: Summary of innovations and information sources

Operation	Innovations	Information/knowledge source
Varieties selection and seed source	-Tall B -not fertility sensitive -good phenotypes selected -shaking off mature kernels -sale of seedlings by some	-own experiences -farmers raising seedlings -observing other farmers -crops/yields
Pre-germination	-Hole and fire method -Manure heap -covering in straw	-From scheme but adapted to suit cold environment -participant observation
Nursery preparation	-Goat manure, poultry manure and ashes	-farmer to farmer, -participant (labour) observation
Fertilizer application	-1 kg per plot DAP -Manure -Burying *azolla*, manure	-Participant (labour) observation -farmer to farmer -discussion in rice group
Weeding	Burying in soggy mud	Experience, experienced workers
Azolla infestation	-Water level method -Burying in mud	Farmer to farmer Discussion in group
Harvesting	-Tall varieties hit on ground after first harvesting seeds	Farmer to farmer Participant observations
Rice fodder	-Sale of rice straw -Feeding milking cows with ratoons and non/low yielding rice plants	-farmer to farmer -groups
Rice mulch	Tomato, French bean irrigation reduction of by 50%	-farmer to farmer
Marketing	Brokers	Brokers
Credit	In kind from brokers (middlemen)	Brokers
Information sources		-Rice groups in the three clusters -Experienced Labourers -Brokers -Participant labour

Farmers gathered information from various sources, with 30% of those interviewed getting it from hired labourers. Topics included nursery establishment, transplanting and threshing. Other farmers (10%) got their information from offering their labour to experienced farmers, while 15% gained information after trials and comparing

with their neighbours. In all cases however, a lot of information used by the farmers came from their own experience and common sense, including trial and error and informal experiment. Farmer-to-farmer information flow was a key mechanism, using local rice growing support groups based on local socio-cultural organisations. Elderly farmers played key moderating positions in the groups. The young and middle-aged farmers in the groups scouted for new information from outside their immediate areas, and were in most cases the first ones to experiment with new ideas on their farms.

The informal rice technology system just described provides a number of lessons for participatory research. One very critical area is the stereotype that farmers are ignorant and have to be trained and corrected, to improve agricultural production. Many of the decisions that farmers make are based on many years of careful observation. This is demonstrated clearly in the above account by rice farmers' decisions to switch varieties based on poor performance, either due to soil type, season or variety (cf. Richards 1989). Another example is their observation of *azolla* where farmers discovered the both a water level control technique and also the potential fertility enhancing and water conservation properties of 'harvested' amounts of this weed. This agrees with Biggs and Clay (1981) who demonstrate that farmers will innovate within the limits of their technical capacity to solve problems of simultaneous adaptation of a technology to both the physical and socio-economic aspects of an environment. Farmers may innovate because they have resources and can take risks, or because they do not have resources and are forced to look for new ways of doing things. They can be young with some formal education or old without, and include both men and women. Farmers may innovate if they were used to a certain way of doing things and circumstances have forced them to survive, in agreement with the synergy hypothesis advanced by Sumberg and Okali (1990) that advocates drawing on multiple sources for innovation strategy.

The Azolla case provides another insight into farmer innovativeness. While farmers used their own ingenuity to control and perhaps make use of the weed, a weed scientist tried to control it using herbicides. The herbicides killed the weed but the farmers were unwilling to engage due to its cost and perhaps also the hazard posed to water sources. Above all, the emergence of jua kali rice cultivation itself, and a very lively post-regulation market scene, with its own credit system, is confirmation that often the real constraint on agro-technical innovation is a regulatory environment that is not fit for purpose. The moment to link farmers and researchers seems to be some time after regulatory constraints have been lifted, with researchers first studying exactly what farmers have been able to achieve on their own. Jua kali rice is a clear example of farmer innovation as a counter-tendency. Group mobilisation and farmer experimentation both played an important part in generating food and cash from areas otherwise considered unsuitable for crop growth. This is in agreement with Clay (1987), who states that technologies employed by resource poor farmers depend upon their immediate environments and hence are systemic in relation to that environment. This signalled realisation that farmers have an intimate knowledge of their local environment, conditions, problems

priorities and criteria for evaluation. This knowledge is out-of-reach of outsiders in ways that are comparable to the inaccessibility of the results of formal agricultural research by poor farmers.

Case 2: *Khat* cultivation in Embu District – 'with these twigs, we feed our families'

Outside a district hospital in Eastern Province of Kenya is a sign board with a No Chewing message next to a No Smoking sign It baffles many who are new to this area, who for a moment think it is a prank. But they are wrong. The chewing in question concerns the leaves of an evergreen tree, *khat* (*Catha edulis*), , or miraa, two among the many names by which this narcotic substance is known worldwide.

Background

The initial cultivation of *khat* in Embu occurred in the mid to late 1980s, in Runyenjes division, which comprises three locations and thirteen sub locations.

Khat is a broad leaved tree whose leaves and stems resemble those of tea, and contain alkaloids - cathine and cathinone - as the active ingredients. These ingredients are responsible for a heightened sense of mental alertness and well being, which when it wears off often leaves a feeling of depression and powerlessness in its place (Beckerleg 2006[9]). This creates a positive feedback reaction, or a craving for renewal of the pleasurable effect.

Commercial cultivation resulted from the conversion of former coffee tree plots into *khat* plantations in the late 1980s, when world coffee prices dropped, leaving many Kenyan former growers struggling to survive. Mismanagement in the coffee and other farmer cooperative unions in Kenya had started way before this period and the global price collapse just helped to make a bad situation worse. Coffee deliveries to the factories were accompanied by unexplained levies, late payments and factory workers with ghost coffee farms. Many families suffered economic hardships and the standard of living worsened for majority of the population. Farmers went in search of alternatives, where in certain parts of Kenya, coffee trees were being trimmed back to facilitate growing of beans, bananas and Napier grass.

In Runyenjes division, farmers decided to try *khat;* my informant, who had a few plants, decided to expand his acreage. Today, almost 75% of the farmers in the division grow this crop and a certain proportion of non growers depend on it for their livelihood. In the official list of crops grown in this area *khat* does not feature, despite its mention in a number of diagnostic surveys done in the area. The official angle is that it fits under miscellaneous crops. In the colonial Kenyan laws, *khat* is illegal apart from 'the Northern Frontier District'. Presently, the crop has semi legal status in Kenyan law, but is highly disapproved of by many authorities (not least the Church).

[9] Beckerleg, S. (2006)What harm? Kenyan and Ugandan perspectives on Khat. African Affairs, Vol 105,number 419, 219-241(23) Oxford University press.

The present case study was aimed at answering the questions related to this crop's production, since it belongs 'in the shadows' even more than jua kali rice. The difference here is that there is official rice research in Kenya, even if cultivating beyond the margins of the Mwea scheme was at one stage illegal. There is no agro-technical research support whatsoever for *khat*. So it is interesting to ask how this crop began to spread, and what its cultivators did to develop a production and related innovation process. To answer these questions, I conducted interviews with farmers, pickers, brokers and retailers in Runyenjes area.

The first interview is with a Mr M., one of the pioneers, who narrated to me how he started and later abandoned the business.

Private consumption

According to my informant, *Khat* growing and chewing, like home brewing of various beers, was once part of Embu peoples' culture. Elderly males and female past child bearing age used to grow a tree or two for their own consumption, but young people were not allowed to consume it. However, this tradition died out and by the late 1960s and 70s very few of these trees were to be found. This was due to discouragement by the churches, as the tree was classified in the same way as cigarettes and other substances. However, as with cigarettes etc., disapproval by leaders of moral opinion did not deter youth from experimentation.

According to M.:

> *Young men who dropped out of school and looking for a pastime activity would go looking for khat [as cheaperthan cigarettes or beer]. This also apply to coffee pickers during the coffee boom in the 1980s, who would chew khat and then pick coffee day and night*. (farmer interview 2004)

He went on to explain how he started cultivation of this crop:

> *I planted my first crop in 1989 after observing many people going to Mr K.'s farm to buy khat. My brother, who was a mason, also decided to try a few trees, together with two others. What happened after my trees were ready for harvesting was phenomenal. I made so much money that I said to myself that I would never waste my time ever with lots of labour on my farm on other crops and get nothing at the end of the season. Consequently I stopped everything else and concentrated on this crop. My lifestyle changed and my brother even stopped his masonry practice to concentrate on the khat business. Customers would come and buy ten shillings worth of khat which I used to measure (weigh) with my hand. After a while, Nairobi buyers started coming to the farm, and since the latter were buying in large quantities the sale strategy changed and we started selling in khat-kilos. Other members in the community also observed the business and realised that there was money being made, and gradually more farmers joined the fray.* (interview with M., a pioneer khat grower)

This continued for five years and then havoc struck. The trees started slowly changing colour and dried up, one by one:

> *I did not know what was going on but on digging up the dry trees, I found the roots were peeled to the core and there were all these brown headed grubs (marindi) in each*

> *and every root. In one stump, I recovered 120 grubs and I also observed some small brownish beetles, but I never suspected any connection between the two, until one day a neighbour told me that beetles were the mothers of 'the marindi'. I suspect irrigation during the dry period introduced the marindi because the beetles look for wet places in the 'shamba' (farm), which they find at the base of the khat plants.*
>
> *After that problem, others followed, including wombo (scales), 'thrips' and 'bevo'(a type of blight). I tried to spray various pesticides but in vain. Some farmers tried to apply fertilizers, but the problem with fertilizers is that the plants perform very well to start with but eventually deteriorate.*

Inter-cultivar intercropping and cross infestation
The story continues:

> *My brother thought of changing from the common variety to the more highly paying muguuka variety. He did not want to uproot the old variety and also did not want to shift the activity to a new area. Thus he interplanted the new variety with the old ones. This is because he had observed a [general] deterioration of the old trees. Gradually, the old trees started dying and eventually, the young seedlings also started dying and in the end all the trees died. ( )*

The trees perform well for five years and after this, there should be new planting on an area that has never been before. However, some people make critical mistakes, as depicted by this case.

My informant expanded his field, and by 1990 consumers came from all parts to purchase the *khat*:

> *Initially, I used to operate this business like a self service store, where I would let the buyers walk into the field and pick the shoots. I would then tell them when to stop depending on the amount of money paid. As the consumers increased, I started picking and packing the bundles ready for the [arrival of] the buyers.*
>
> *Some buyers came from as far away as Muranga (80 kilometres distant). They would buy in large quantities and later sell it to retailers. All this time my neighbours thought… I was crazy and associated me with all kinds of bad things. They only realised what I was doing when, with the proceeds from the business, I constructed the biggest water reservoir in the village in 1993. You can see over there.*

My informant said, pointing to a water reservoir with 'July, 1993' inscribed on it as construction date. He also purchased a few plots in the local shopping centre and in his own words:

> *Life was very good during this period.*

My informant then encouraged two of his friends to engage in cultivation of *khat* and they also showed the crop to a few of their friends. By the late 1990s and beginning of 2000, *khat* growing in Runyenjes had taken root and the local economy started showing signs of revival.

An outbreak of famine in the year 2000 also led to expansion of the *khat* fields, after families were forced to buy maize from external traders. Only families with *khat*

could afford to buy this imported maize. Farmers who were not very keen to plant the crop earlier on were convinced by this experience to try it, and from then on *'khat became like a flower in many peoples' gardens'. (farmer interview 2004)*

A few pioneers of this business are still cultivating the crop, but others like my informant have stopped, and today reminisce about the good old days. When I asked why he abandoned *khat* cultivation, my informant shook his head and using a local saying said:

> *'Reke ngwire, gutiri ndegwa irumaga imeera igiri'* (Let me tell you, no bull growls (dominates) for two seasons).

He then added:

> *While I blame myself for the lifestyle I assumed as a result of the income from khat cultivation, I also blame disease infestation, insect pests and other maladies that attacked my trees, leading to their decimation and eventual total loss.* (interview 2004)

Today, the stumps of the old *khat* trees in M.'s farm desolately stand among his other crops. A few remaining trees are overgrown, and covered with lichen, while others are shaded out by other trees.

Khat as a springboard to other ventures

Some pickers bought bicycles using cash from *khat*, and are now the '*boda boda*' (bicycle taxi) operators. Others have bought radios, cows, and goats, and one even competed his secondary school this year using *khat* money to pay his school fees. He used to go to the market to sell every Wednesday and Saturday.

This business is very organised. There are pickers, carriers, brokers, wholesalers, retailers and consumers. Formerly, brokers used to go to the farms, but this has since changed. They wait for the produce on the main road at various destinations. They give out money to pickers and the latter go into the farms. The arrangement is usually made a day in advance and collection is done the following day. Mobile phones are very handy in this business as we are going to see soon.

Cultivation of khat

The propagation of *khat* is done using five different techniques currently, but more *khat* producer experiments are underway. The current methods are propagation through adventitious shoots, air layering, root induction and cuttings and grafting. None of these methods was introduced by extension officers, since as will be seen later none of them wants to be involved.

Root shoots are used, due to the plant's ability to produce shoots from its adventitious roots. These shoots are extracted carefully from the soil, ensuring that there are enough roots left intact on the shoots because:

> *If you are in a hurry your take up rate will be zero.* (farmer interview 2004)

The shoots are placed in small polythene bags and nurtured in a nursery. They stay in the nursery for a period of two months, after which they are transplanted.

Air layering is also used, where a polythene bag is opened at both ends and a part of a branch is fitted in this bag after peeling round the bark from a small section of this branch. At one end, the bag is tied tightly to the branch and then filled with soil and the second end is tied to hold the soil in place. After a few weeks, the ringed section produces roots and the new plant is ready for transplanting:

> *If you come to my farm when I am doing this you will get the impression of sausages growing sausages on the trees.* (farmer interview 2004)

A variant of this method is the burying/covering of mid sections of branches close to the soil surface with a layer of soil, a process similar to *gukinyithia* in sweet potatoes, which is the partial burying of runner branches. Adventitious roots start forming on these branches and the new plants are then separated from the mother trees.

Very young plant shoots are also severed from the trees and covered with airtight poly bag as in the case of propagation of tea. This method was found with a few farmers, who did not seem very keen to discuss it. It is used for propagation of *muguuka*, which is a particularly difficult type of tree since it does not put forth as many shoots as the other types.

Some farmers have taken that opportunity to specialise in raising seedlings of this unique variety and thus:

> *I raise seedlings for sale and so why should I pour millet to the birds?*

Says one farmer, in response to a question as to whether he shares his skill with other farmers. This farmer guards his skill by doing the propagation in a shed that he has prepared next to his cow shed, and not in the *khat* field where everybody has access.

Grafting is practiced by a few farmers, using scions from desired trees on the less desired trees as root stock. This practice reflects the observations farmers have made over time on trees that do not appear to suffer from many problems. A few farmers have specialised in this process and charge a fee for the service. The method is an adaptation from coffee, which is being used to convert old trees to a new disease tolerant type.

All the above propagation skills are adaptations from other trees. Farmers learn from each other by discussing, and also by visiting each others' farms, while others pay for the service.but as illustrated by the one farmer above, there are others who jealously guard their skills for financial reasons.

Transplanting and weeding

After two months, the young plantlets are ready for transplanting. Round or square holes are dug, and range in size and depth, with the main aim being efficiency in water harvesting. Manure is applied and mixed with the top soil and returned to the bottom of the pits. The seedling is then placed in the hole, and mulching may or may not be applied at the base.

The holes are spaced at various intervals but the tendency at first was to use the standard coffee spacing of three metres from tree to tree. A few farmers later adjusted this spacing :

> *I changed the spacing to a shorter one after realising that I was wasting a lot of space in between the trees, leading to abundant weed growth.* (farmer interview 2004)

By reducing the spacing and letting the intra-tree canopy overlap, the plants provide a good ground cover for the fields. This then reduces the weeding load, since only the inter row paths are weeded. A rough estimate form farmer explanations showed that this reduces the weeding load by almost 50%:

> *Weeding is performed to remove weeds from among the khat trees. This is done using 'pangas' (machetes) this was different from earlier on when we used fork jembes (three pronged hoes) but we realised that with hoes this practice was exposing the roots (farmer interview 2004).*

According to some informants, weeding is important, but perhaps different from what an agronomist might suppose. The weeding here is about allowing a dew-free passage through the rows for the pickers who refuse to pick *khat* from weedy fields or double their charges when presented with such fields. This is because picking takes place early in the morning, before day break, and the pickers are bare footed or adorned in car tyre *akala* sandals. Pickers hate having cold, wet feet.

Picking, pruning and pest control

The portion of the field to be picked is normally identified by the head picker the previous evening, in consultation with the farm owner. The *jeshi* boys (or pickers) arrive in the farms at 5 am in the morning and knock at the gate. The locals have named this hour of the day the *jeshi hour.* It has become the waking up time for the village as a whole.

Once in the field, twigs from the bushes are broken and put into a container. The shoots are normally broken and not plucked as is the case with the Meru type of *khat*. Afterwards, a specialised member of the *jeshi* boys group is asked to pack the twigs into 'khat kilos'. The 'khat kilo' is a spherical bundle of *khat* twigs wrapped in banana leaves, with eight of these then packed in a yellow polythene bag. The kilos are counted, the owner is paid, and then the *khat* is delivered to the collection centres located where the farm roads intersect the Runyenjes-Nairobi road.

After several pickings, pruning is done to remove the swollen shoots and to provide for more sprouting. Branches which are too low are also removed to avoid soil borne pests or pathogens from attacking the trees. Some farmers are experimenting with a new method where they train the *khat* bushes as in a tea plantation. Thus:

> *I have selected that portion where I did heavy pruning, after which I will gradually train the bushes to form a "tray" like in tea, and see if production will be affected, after which I will leave the whole of my field that way.* (farmer interview 2004)

As has been mentioned earlier, various pests attack the plants, including chafer grubs, scales, thripps, and diseases such as blight, fungal infection and others.

Farmers have resorted to pesticides usually applied to other fruit trees. Some farmers reported having inquired from the stockists of these pesticides, who often sell to them whatever is in stock. The farmers then go through a process of trial and error, and in the process mix up as many as four different types of chemicals.

The spraying is done sequentially, i.e. one side of the field is sprayed and the other left for picking, until after two weeks pickers can go back to the sprayed section.

Non chemical methods are also used for chafer grub control. These include burying of ripe avocado fruits at the base of the *khat* trees. Red ants are then attracted by avocadoes and feed on the grubs. Onions and O*cimum canum (*a heavily scented Basil-like plant used by honey bee keepers to attract bees) are also inter-planted between the trees to repel the insects. Other non chemical measures include application of ashes and fertilizer.

The case of fertilizer is unique, because as with weeding the purpose of application is different from what a soils expert would intend. The fertilizer, according to an informant, is a means to kill the chafer grubs. This is again out of experience where a farmer noticed many dead grubs after having applied fertilizer to improve tree performance.

Irrigation

Irrigation is necessary during the dry February to April months. Formerly, hired labourers would be engaged to draw water from the rivers for irrigation but a new trend has set in. Petrol or diesel engine pumps are increasingly being used. This has opened a new kind of business in nearby Runyenjes town. Dealers of these pumps are quickly setting up shops in towns for sales and after-sales service, since so many farmers are now buying these pumps. Water is pumped from the rivers, and some new types of business have sprung up where non growers buy pumps to rent out to growers. Some growers have sunk wells in their farms. Wanjihia has two wells in his farm:

> *Because I do not want to take chances with my precious crop. (farmer interviews 2004)*

These pumps and wells are also used to irrigate other crops like tomatoes, French beans and other horticultural crops, but a lot of farmers said that these other crops (such as French beans) are a bother:

> *French beans and tomatoes tie you down and those con men (buyers) give you too much trouble. They arrive like lords at 3pm to collect the produce and you spend your time waiting for them. If their vehicle breaks down (which often happens)or there is over supply in the market, you get stuck with your beans or tomatoes, and you still have to pay the pickers who do not care whether you sell or eat them…… With khat, once the produce is outside your gate, you do not care what happens to it any more since you have your money in your pocket.* (farmer interview 2004)

Farmer organisation, chiefs, church and khat

Khat farmers tried to register a *khat* growers society, but the social services officer rejected their application. He said:

> *Yours is an illegal activity and hence does not qualify for registration.*

Since the farmers had already collected registration money from members, they thought about how to circumvent the issue. They sent a fresh application and registered a general crop producers group. Thus:

> *We are therefore registered and every month we contribute money for welfare and we hold meetings every two months. In between, we discuss various issues to do with khat, and especially marketing.* (farmer interviews 2004)

Before 2002, it was very difficult to have a gathering of *khat* farmers and if government officials or chiefs were invited they would not come '*or even support any of our ideas*'. The chief did not want to appear if he was invited, since he did not want to lose his job, it was claimed. But today in one of the locations '*the chief chews khat and grows some too*', my informant tells me as he nimbly chews away at some succulent *khat* twigs.

The church used to be strongly opposed to *khat*, and at one time social ceremonies such as weddings, baptisms, funerals, etc., would not be conducted in a compound of a family growing *khat*. This was socially devastating to affected families, but it was circumvented by cutting back the orchard to the ground before the occasion, and the trees would sprout thereafter. Before full sprouting, the family would be set back economically. In some cases families would be ex-communicated, like this one, who narrated their woes to me:

> *We were excommunicated when our neighbour reported us to the church. We then decided to join the NICA church where they do not have this nonsense. When the 2000 famine set in, our neighbour wanted to grow khat, and we sold him the seedlings at twice the price, as a penalty for what he did to us. He had to pay and we are no longer bitter with him.* (farmer interview 2004)

My informant continued:

> *Of course even though the church has been discouraging us, they could not buy us food during the famine and furthermore they are also in need of money for their development activities. Consequently, there are some churches that have even started conducting prayers to bless the khat fields prior to first planting and a relationship between the owner of the field and the church develops with no doubt some financial benefit to the church.* (farmer interview 2004).

Khat growers have developed a special kind of solidarity, perhaps due to the ever looming threat from the administration, who for a long time (as mentioned) classified the crop along with illegal brewing and drugs. A close working relations between *khat* growers was observed in the field, as they will come to each other's assistance in case of need. They also once in a while organise social gatherings where general issues affecting the growing of the crop are discussed.

An interesting case in point is the solution to the problem of theft of *khat*, which used to be rampant at the early stages of *khat* establishment in the area. At this time any one could pick *khat* and deliver it to Nairobi for sale, in which case the produce was

readily stolen and sold. The farmers then agreed that only authorised brokers would buy their *khat*, and an arrangement was made with them to organise the pickers so that they harvest the *khat* in a systematic manner, moving from one farm to the other on a regular cycle.

Due to this innovative arrangement, theft came to an end, since every consignment of *khat* bought by brokers was from a known farm and picked by a certain group. This introduced a kind of 'track and trace' system into the *khat* sector. It also helped to regulate the quantities of *khat* on the market at any one time, thus ensuring price stability.

Khat marketing - interview with Charity
The traffic is building up on Muranga road just before the Pangani shopping centre roundabout. It is a quarter to ten, according to the city clock, and the *matatus* (or Nissan public service vehicle taxi's) are busy dropping and picking up commuters. Occasionally a *matatu* diverts from the main road and turns left, as if heading for the Pangani estate, and stops outside a green kiosk where I am standing watching the process. The conductor jumps out of the Nissan and yanks the boot door open. Arranged neatly under the rear passenger back seat are several yellow polythene bags with banana leaves protruding from their tops. Three overcoat clad men approach the car and start removing the yellow poly bags from the Nissan and record the names written on them, handing them to the waiting retailers.
Meet some of the actors involved in the marketing of *khat*, as they go about their business on the outskirts of the city of Nairobi.

Charity[10] dropped out of school in 2002 and after searching for a job in vain settled for the *khat* business. She started by supplying *khat* to middlemen who used to frequent farms in her home area in Embu. In 2003, she decided to venture out of her home area and move to Nairobi. When I approached her for the interview, she had just collected several spherical polybags from a Nissan and was displaying them for customers. In this interview, she explains how she joined this business and how she conducts it.

C.: I started selling *khat* in 2003. My *khat is* from Embu, and a kilo (a bundle wrapped in banana leaves) currently costs Ksh 200 (about 2 Euros) because this is low season, but costs Ksh 500 (5 Euros) when it is high season. I have a manager back in Embu who organises the purchase, and the produce is then transported to Nairobi through the Nissans. If I need to convey feedback to him about the produce, I call him on his cellphone, and he does the same if he needs to know the quantity he should deliver to me.

Customer interrupts
He picks and sizes up a packet, then puts a few twigs and samples in his mouth. C tries to convince him that the material is good but in vain. Without a word he moves

[10] Not her real name.

on. Charity removes a new bundle from a yellow bag and puts it in front of the other bundles. I notice that this new bundle is fresher than the other bundles.

I ask her what the difference is between what she sells and what is obtained from Meru and she explain:

> *The difference between Embu and Meru[11] khat is that with the Embu one you chew the leaves while for the Meru type you chew the bark of the twigs. Here … (she explains as she pulls one twig from a bundle in her neighbour's wares and shows me how to peel the bark).*

She goes on to elaborate that the Meru one being sold is the one rejected at the airport. She goes on to explain that the potency of the two types, where the Meru type is said to be more potent, but other people believe that the Embu one is more potent. She ends by saying that customers are very specific on the type that they consume and preferences are fixed. The Embu type is not exported because according to her, its keeping quality is a problem.

After the produce is picked from the farm, it is packed in *khat* kilos, and wrapped in banana leaves, and then the eight kilos are fitted into each yellow paper bag and that is what is delivered to the wholesalers and retailers. There are people from the office who receive the *khat* and then ensure that all is safe, she further explains and for that service the sellers are charged Ksh 50 (50 Euro cents)per day and this is the amount that also caters for the city council dues and the cleaners.

A customer- comes and makes an effort to pick from the lot and then feels the bundle as if to feel its density and then chews a bit. He asks for the price and then haggles with C. He produces Ksh 150 but C says it has to be 200 or nothing. He moves on muttering some incomprehensible words which C ignores.

During the rains the trees produce a lot of shoots and this leads to low prices. Currently, we are going through a low season due to heavy shooting of the trees caused by the recent rains. During the dry season, prices are high and the retail price goes up too.

When I ask how this problem is dealt with, Charity says:

> *We normally lower the prices but also the office (the one that receives the khat) is helping by introducing a quota so that every dealer receives a certain amount and no more.*

Charity says that they are six women in the market place but the rest of the sellers are men. However, if customers like the product you are selling they will come to you irrespective of gender. In fact some of our clients are ladies who either consume *khat* or retail it in Eastleigh and other places. In any case some men also become our customers, thinking they will intimidate us but they meet their match.

[11] Meru *khat* is the one that is flown to different destinations world-wide.

2nd Interview

John is a young man in his early thirties. He combines *khat* business with a small cigarette shop. He says he gets his supply from his manager, who makes the decisions on which farms to get his supplies from. He expresses the same sentiments as Charity about the rain and the reduction of prices. He states that at times he receives *khat* which has been damaged by insects or has malformed leaves. He calls his agent and cautions him to be more careful. John states that there are no fixed customers in this business, but they will return, depending on how you talk to them. He also says that:

> *It is possible to tell varieties apart based on leaf characteristics and rate of deterioration, which varies from one variety to another.*

3rd interview

The discussion with the sellers in Embu town revolved around the issue of different *khat* types and whether there were preferences for any specific varieties among the sellers. From the discussions, it emerged that the environment determines the taste thus:

> Mbeere *khat* is dryish and not as succulent and watery as the Runyenjes one.

They attribute this to the 'dryish' Mbeere environment and the wettter Runyenjes environment. The dryness and sappiness are important characteristics that determine the shelf life of the *khat*. The less sappy the *khat*, the better the keeping quality. It was however mentioned that in either case *khat* is very delicate, and irrespective of source, it needs speedy disposal. In the words of one seller:

> *Khat is a business where every morning fresh produce is handled.*

According to the discussions, customers would know if you sold them *khat* from a different zone-and would run away from you or come in droves.

On the allegation that *khat* has bad side effects, informants differed:

> *It makes you feel less hungry (hence you can wait for the next meal), reduces libido and hence can be a good family planning strategy, and reduces craving for beer, especially cheap brews, and is less crime oriented. The criticism is out of ignorance (one informant adds). In fact, we'd like you to come here one of these days at around mid-day and observe even doctors from the district hospital and other prominent people of this town mingling freely with our other customers seeking this product. Some also send messengers to buy, so that they can chew in their offices and homes. Can that be a bad product after all? Tell me why do they want to condemn such an important crop and allow tobacco, for which the government even employs extension officers… Hii yote ni siasa (this is all politics), he adds. (interview 2004).*

The informant goes on to explain that the crop employs many people and has very strong networks, and what is more the money benefits the local people directly, unlike coffee, tobacco or tea which passes through many hands before payment finally getting to the *mkulima* (farmer).

> *With khat even 0.1 acre can fetch Ksh 10,000 in a week, a sum which can never be earned by coffee.*

> *In this business we call each other 'names' (insults) as we do business but at the end of it all we laugh together. This is unlike in coffee, where people laugh as they tend and pick the coffee, but call each other names and gnash their teeth at the low prices offered. The far-off trader laughs all the way to the bank and has the last laugh. In the khat trade the locals laugh all the way to their homes and families and unemployed youths like us are able to feed, clothe, educate and entertain our families with these twigs.* (farmer interview 2004)

On problems that they encounter as traders, informants said that:

> *..the police and other authorities used to come down strongly on us, but that was during the KANU days. The NARC (new government) has no problem with us. It is a money spinner and the sooner the government does something for the khat farmers the better things will be, especially for places like Mbeere. I collect money for the council from the khat dealers here in this market and I can assure you it is not little money. (interview 2004)*

Views of non growers

On asking the opinion of a female respondent about *khat*, she says:

> *It is a lucrative business in this area and people have constructed stone houses (a wealth indicator) from the business and they also take their children to high cost schools. The pickers are youths and that is one aspect I do not like about it.*

On asking if it is not an advantage to keep the youths busy she says:

> *I do not think it is an advantage. In this area, as a result of the money from this crop, youth are clamouring to get their share of their fathers farms, like the biblical prodigal son. In fact some are not even yet youths. They are "babies" in primary school who find it so appealing. When parents show hesitance, the children rough them up and in a few cases serious injuries have been inflicted on parents and even deaths have resulted. Once the young generation tastes money, they are uncontrollable. There are, however, some who behave responsibly and have initiated very useful projects. Some of the churches discourage its followers from growing and using khat. Other denominations allow it, and some have even gone to an extent of organising prayers for the trees at planting time. My faith does not allow me to indulge in khat since it is a drug. (interview 2004)*

On security in the area she says that:

> *To an extent security is compromised by this khat and consequently vigilantes are employed by the concerned people. There is an emerging trend which I feel is a problem in this case and that is the smoking of other substances like bhang and cocaine. This when combined with khat becomes very potent. (interview 2004)*

Responses to a question whether the marketing of *khat* could be emulated in other crops were mixed. A cereals dealer remarked:

> *Yes because you get money instantly and hence you can do other things with it. This is a perishable crop while produce like cereals are comparatively durable. The consumption of these other crops is not as rapid as khat. Also the channels vary quite a bit. For instance, as a dealer of cereals, I can arrange to buy maize from producers in small amounts and then bulk it for bulk sale to bigger stores. These ones have to store the produce until they get a suitable buyer and this may take time. It needs someone to*

> *be able to absorb that cost. In khat however turn over of cash is rapid. I however think there are certain aspects that can be emulated, but not all of them. (interview 2004)*

Interview with agricultural officer

I started by asking if farmers have been coming to the office seeking for information on *khat* growing. His response was:

> *I remember we had a lady District Agricultural Extension Officer (DAEO) one time in this office. In one of our staff meeting, someone raised the issue of khat and it was discussed. The DAEO advised us to just monitor what is happening since the issue was already too far gone. Otherwise, I also remember there was one boss who was issuing warnings to the effect that any officer indulging in khat cultivation would be chucked out of the service. (farmer interview 2004)*

On the question of what the office has been doing about the cultivation of *khat*, since it is presumably displacing some of the mandated crops, he said:

> *There are no official husbandry practices and what the farmers know is from their own experiences. The estimated average size of land is a quarter acre of the crop to about an acre. I have not come across a farmer with more than an acre of the crop. We have an estimated hecterage of 800 hectares.*

On whether there is any other motivation besides cash, the answer was joblessness. Youths ask for some land from their parents and since population pressure is on the rise they can only get tiny pieces. These pieces are not sufficient to grow a land extensive crop. *Khat* fills the need very well due to its small land size requirement. It is also a crop that does not require a lot of care owing to its forest origin.

> *Some of these boys have been able to put up decent houses on their plots and their standard of living has generally gone up. They have also been able to send their siblings to good boarding schools where the fees are rather high. Some even pay a whole year's fee in high cost schools upfront. Women are also surprisingly the ones who initiate the cultivation of the crop. These are both the young and old ones. They plant a few trees to be used for buying "salt" and other household requirements/necessities. The men take over the plantings and expand on the acreage.* (interview with agriculturalist 2004)

The *khat* system is very well organised. The owner does not normally do any work in this system. He owns the 'shamba' and employs people to do the work for him.

G: Do you think there is any relevance of this crop to what you are trying so hard to do in your official role (as an extensionist)?
N: Yes, I believe there are certain lessons that we can learn from the level of organisation and management of this crop, but officially we are unsure of the government policy on this crop.

Social services officer

On being asked about his views on *khat*, he said:

> *Khat is an evil that has invaded this area, the pickers are crazy boys that I pity. The lot in this area are beyond help. I do not want anything to do with that lot. I received an*

> *application for group formation and I threw it out, and if I get an idea that a group was involved in any way connected with khat production I will deregister them.*

He adds:

> *The government is strongly opposed to khat cultivation. We did a PRA with MKEP and also the Embu town social services office and developed CAPs. Youth cannot form into groups because they chew the khat and they become mad. Houses in the area are constructed through a Habitat project. Don't you see they are all similar? These people pay Ksh. 600 per month and let no one deceive you that the houses are being constructed using khat money.*

What about tobacco which is legal but also a drug, I ask and he answers that this is a different matter:

> *Because we have guidelines from the government that govern its use and extension. Khat is a different matter since it is in the bush and farmers do not know its effects and continue involving themselves blindly.*

When you say blindly what do you mean?

> *I mean the government and even you people in research do not know anything about the crop, and hence how can the farmers cultivate it without guidelines? Also how can we in the office involve ourselves with a vague crop?*

I ask: 'Do you think it is possible to harness the cash from *khat* and use it in different ways, like supporting growing of other "legal" crops? Like the pumps that they are buying and not only using them for *khat* irrigation?'

His reply:

> *Mhhh… maybe that is a good idea, but still guidelines on this crop are necessary for a lot of things to be done… but some of the pumps are not bought from khat cash… I think.*

5. Discussion on *khat*

The case of *khat* is a unique one, in that the farmers have been forced by circumstances to search for an alternative cash crop and in the process have ended generating a highly organised system of production and marketing. Jobs have been created in the process. *Khat* transportation is a new business niche for the Nissans which is an innovation by the dealers. In the conventional *khat* business conducted in Meru, special pick up trucks (also called 'road planes') are used. These are recognisable by their high speed and the two spare tyres attached to their back door. The speed is associated with rapid breakdown of cathinone, which starts deteriorating immediately after picking. Speed is therefore of essence to deliver produce as fresh as possible.

Farmers have also come up with various innovations, including non-conventional use of weeding operations (for dew avoidance), fertilisation (for chafer grub control) and use of fruits (to attract ants to feed on grubs). As Collins and Evans (2002) argue, farmers in this context become 'experience based experts'. New businesses are also springing up (notably water pumps) which are also being used for irrigating other crops. Youth are also engaged in a business that may save them many of the

problems that many who end up in the cities have to contend with. While low season for farmers means low production, it means high season for sellers due to reduced supply and vice versa for high production.

While it is apparent that some farmers are not very keen to share their skills with others, a general spirit of sharing is evident among the *khat* growers. It is also evident that their initial attempts to register as a group did not discourage them from trying to tap some of the development benefits of this mode of organising. While this enthusiasm may at first seem puzzling, it seems that a major motivation is to gain the recognition from the state that amounts to a kind of legitimacy, for a crop in the shadows, concerning which officials entertain doubts about its legality. While not much assistance is coming from the government, which is also the case with other groups, registration gives the farmers some psychological satisfaction. Sharing of information through social occasions is similar to the one found in the rice cultivation and same applies to participant labour and hired services.

In general, the key point to be made about the *khat* case is that it shows a considerable potential among farmers and other rural agents in Kenya to organise and solve technological and marketing problems even where there is no research base or other technological or organisational resources emanating from the public sector. Where farmers do their own thing, but there are official recommendations, they are sometimes castigated as stubborn or stupid for ignoring them. In the *khat* case, where there is simply nothing officialdom can offer, it is striking to find this world of ingenuity and adaptiveness quickly written off by officialdom as a wild, threatening domain of youth anarchy, and that tobacco (by contrast) presents no problems because there are 'guidelines'. It may be wrong to presume (as do some of the informants portrayed here) that this is 'all politics', but the case offers striking evidence of what Mary Douglas defines as 'the institution doing the thinking' (Douglas 1986). The challenge for participatory agro-technology is to get the institution to think differently.

6. Conclusion

In this chapter we have observed that the group approach is a suitable approach for research scientist to work with as they deal with many intractable farming problems. As indicated by other authors (e.g. Kungu and Mwania 2000) group approaches provide alternatives to the single channel interaction. The chances of dialogue in such a case are enhanced and hence, research scientists have a chance to work cooperatively with the farmers, not only in diagnosing problems that farmers face but also in planning for interventions which again farmers have ideas about.

When we focus attention on group selection, we find that research scientists have very little control over the groups they work with. They rely more on what they get from their collaborators. This is again understandable if at times unfortunate, since research scientists are not as conversant with the field as the extension staff. The lack of true randomness in group selection may be creating a situation in which

'progressive groups' replace progressive farmers, with similar results, in terms of failing to address the problems of the majority.

In the case of group activities, it is apparent in all cases of groups working with research scientists, that technologies were modified by the farmers. But apparently, few of any of these modifications was followed up by scientists. In one project however, the scientist were able to follow up and even suggest that the modification could be used to develop second generation projects. Discussions held at the beginning of the season with the concerned research scientist indicated no ideas on follow up. The issue of modification did not arise, but at the end of the season this perception had changed and became a strong point of the project. This indicates the true potential of the participatory approach, and attempting to build on this kind of reaction should be stressed.

The prevailing impression is that group activity is still seen basically as a way of getting over a technological message. This is why the information reviewed in this chapter about farmer based groups working independently is so important. Kiptot (2007) shows that many agro-forestry groups in Kenya, exist for other, non-technological, reasons, and that as a result of a mismatch between group and researcher purposes participation yields poor results. Here, the material points in different direction – there are some kinds of groups (as in jua kali rice and *khat*) where there is a genuine technical focus, but for a variety of reasons official research cannot or will not form an effective partnership If the *khat* and rice cases establish a genuine potential for group-based agro-technical development then the challenge is to locate groups where true agro-technical purposes are encountered, and around which effective partnership projects can form. Choice of groups could be based on criteria like the past history of groups and the activities they have shown serious interest in. Technology development and testing should then pick up from the point these groups have reached, rather than seeking to interest such groups in pre-cooked research agenda. The overall message of this chapter is to spend much more time researching groups before beginning joint activities. In the next chapter attention will be paid (via further field work examples) to what might need to change in the participatory approach to ensure a new social ordering of innovation processes in rural Kenya.

7. Annex

Annex 1: Results of soil analysis on Azolla plant samples and soil samples

	Soil Analytical data							
Field/plot	Nyaikungu 1 (Thumaita)		Nyaikungu 4 Thumaita		Kanyiriri-Jenalo		Kanyiriri Keneth	
Lab #/2005	568/04		571/04		580/04		583/04	
Soil depth	0-20cm		0-20cm		0-20cm		0-20cm	
Fertility res	Value	class	value	class	Value	class	Value	Class
Soil pH	6.40		6.20		6.0		6.30	
Total N%	1.00		0.76		0.37		0.36	
Org Carbon	3.05		2.20		1.28		1.20	
P ppm	30		24.9		23.9		26.9	
K me%	0.7		0.20		0.08		0.20	
Ca me%	39.25		40.50		13.0		17.0	
Mg me%	42.6		41.5		9.20		10.4	

Analysts notes:

Soil PH: The soils range from 6 to 6.4 ph range . Almost all nutrients are available within this pH range

Soil organic carbon: Moderate – Recommnendation: Apply 2 - 5 tons of manure or compost to maintain soil organic carbon

Phosphorous: Sites adequate in available Phosphorous, Calcium: All are adequate to high in Calcium

Mg: Available Magnesium excessive in all sites

Micronutrients: Cu, Zn, and Mn are adequate in all fields while Iron is excessively high which may result in toxicity.

Plant Samples: Azolla spp.

The plant materials chemical composition indicates high levels in Nitrogen and Phosphorous and low levels of potassium. This shows that they are heavy feeders in N and P and hence it may be interpreted that they highly compete for these nutrients with other crops. The chemical results indicate low levels in Ca, Mg, and K meaning low feeders in the same. Sodium is in adequate supplies for all samples. These plants or weeds do not seriously compete for Ca, K and Mg as indicated by low levels of their analytical results

despite the fact that they are very high in the soils especially Ca and Magnesium

CHAPTER 6

FARMER-INTERMEDIARY INTERACTIONS AND FUNCTION GROUPS

'Heterogeneous networks, social innovations: public-private partnerships?'

1. Introduction

In this chapter we use two farmer categories to illustrate interaction with partners whose core business in one case is with a farmers product (macadamia nuts) and the other with a process (effective micro-organisms to enhance compost manure decomposition). The two cases illustrate how products on the one hand and farmers and partners (social actors) on the other form an 'actor network' facilitating mutual exchange of information as well as flexible operations to enhance attainment of expected outputs. We also include a third case – that of a school group engaged in a participatory learning exercise involving rapid multiplication of sweet potato planting materials – to illustrate how KARI might practice agro-technical science with groups organised around other functions than agricultural technology development (school groups and other similar groups, further called 'function groups') in order to build a potential for enhanced two-way information exchange. The research output (data collected) is then utilised in the school system in which the group is embedded thus forming a heterogeneous network for school management and enhanced technical outputs.

The three cases are used to illustrate the free exchange of information that takes place between the actors in their respective projects, and how this approach would enhance utilisation of jointly developed innovations. While the research institute is involved in one of the case projects, it has distanced itself from the second one. This is partly owing to rigidity in bureaucratic operational procedures, and partly to personal factors and a failure to recognise useful feedback to enhance the utilisation of institute-developed technologies. The cases attempt to illustrate the multifaceted nature of technical innovations and the need to form technology supportive networks within which to anchor innovations. These cases attempt to illustrate that embedding of an innovation in any context is the result of the interaction between the social and non- social elements, and hence laying too much emphasis on the technical side renders the process unsustainable. They also illustrate that while the members of these categories explicitly act individually they tacitly form groups that have a common purpose, and through formal and informal links, learn from each other and from the partners in a flexible way. In so doing, farmers, partners and outputs from their projects form a network of both social and non-social elements influencing production practice, and at the same time enhancing information flow between and among social actors.

2. Case 1: Macadamia production and marketing by smallholder farmers

Setting of the case study

Smallholder farmers in the Embu region have been growing macadamia trees since the 1960s, with the original idea of cultivating a cash crop. However, a combination of biotic and abiotic factors undermined the viability of this venture. Even so, farmers maintained the trees. The venture has been re-awakened by the moving in of nut processors who helped form a farmer-broker-processor partnership. This has led to opening up of private nurseries, and even of renewed individual farmer initiatives.

This was apparent during the mission to study farmer researcher groups, when we focused on activities groups were conducting. One was establishment of nurseries for raising macadamia seedlings. We found out that a whole new way of farming and marketing had emerged, following the re-launch of macadamia tree farming, as illustrated by newspaper article quoted below:

> *Documents seen by the Herald show that the macadamia nut kernels, worth more than $200,000, were imported from Kenya, repackaged in boxes labelled 'product of Australia' and sold to hundreds of shops. The documents show that in August the company took delivery of 14,175 kilograms of the kernels, worth $223,000… imported from Kenya.* (The Australian Herald, November 24, 2003)

The quantities mentioned are an indicator of a substantial output from what originally was a 'failed' project, but concerted efforts between the farmers, their children, the research institute, donors and processors led to its re-emergence. Farmer experimentation and experience, farmer-public sector collaboration and farmer-private sector partnership, as well as international transactions, are all evidenced in this case. The article indirectly linked the farmers' nurseries with events happening in Australia, from where the six macadamia kernels that gave rise to the Kenyan Macadamia industry originated.

Macadamia - a botanical account and uses

The Macadamia nut tree belongs to the family Proteacae which consists of eleven species, with only three having edible nuts, and two of these being of economic importance. The species in question are *Macadamia integrifolia and Macadamia tetrephylla,* with M. *Integrifolia* being superior in yield and nut quality, and having a higher oil content than nuts of M. *tetrephylla*. The tree produces dessert nuts of very high quality, unique taste and flavour, eaten fresh or salted. The product is rich in unsaturated fatty acids with an oil content of about 88% (De la Cruz et al. 1966). The high unsaturated fatty acid content is beneficial to health in the maintenance of low levels of blood cholesterol.

Main uses include extraction of salad or cooking oil, and cosmetic and soap manufacturing. The oil cake after extraction can be used as animal feed when mixed with high fibre fodder crops. Diced kernels are used in confectionery ice cream and

chocolate making industries. The hard kernel shells can be used for charcoal and the wood is hard, thus serving as durable timber.

Presently KARI, through the Macadamia project of Thika horticulture centre, is doing research on propagation techniques, including tissue culture, plant nutrition, crop protection and breeding; much new information has been generated since the generous gesture of the 'six kernels' sixty years ago.

Macadamia – 'revisiting a contested project'

Macadamia was introduced into Kenya in 1946 by a farmer who brought six nut kernels from New South Wales in Australia when visiting a farmer in Kenya. These nuts were planted by the host farmer, Mr. Bob Harris, in his farm near Nairobi and in the next 18 years, seeds from the original six trees were multiplied and used to establish 40 acres of Macadamia.

In 1964, the government decided to commercialise cultivation of Macadamia and awarded the propagation contract to Bob Harris Limited who imported two of the economic species and a hybrid from Australia. In 1967, this company supplied a total of 126,513 seedlings to farmers in Eastern and Central Provinces of Kenya (Table 1). A further 1.2 million seedlings were raised and supplied to small holder farmers in Central and Eastern Kenya in 1968.

Table 1: Seedling supply to parts of Kenya -1967

Province	Seedlings
Central	84,257*
Eastern	18,367**
Rift Valley	11,545
Western	12
Coast	31
Others	12,301
Total	126,513

*Kirinyaga district -11,474 , **Embu district -12,297 seedlings

(Source: MOA-1967)

These trees were inter-planted with food crops and in some cases with other tree crops like coffee and other orchard trees. Following a misunderstanding between the contractor and the ministry of agriculture, the con tract was terminated on the advice of a consultant. Thus further distribution of seedlings was halted.[12]

The fruiting age of these seedlings was six to seven years and the yields were highly variable. Some trees produced high and good quality nuts, while a majority

[12] This was due to the unsuitability of the propagation method and the fact that the trees cross pollinate in nature, which leads to a failure to breed true to type. The termination was in spite of heavy investment by the contractor, who had imported processing equipment consequently taken over by the Kenya planters coffee union (KPCU).

produced low and poor quality nuts. Others never produced any nuts. The morphological characteristics were also as varied as the other agronomic characteristics. This was a great disappointment to the farmers, owing to the publicity campaign that the government extension agents had put in place. The immediate past experience with coffee (refer to Swynnerton plan Chapter 2) had heightened the farmers' expectations, but unknown to all actors, the new tree exhibited its varied genetic and botanical characteristics to the full. Farmers reacted to this catastrophe in diverse ways. Some disappointedly uprooted the trees, while others simply ignored them and let them grow just like any other tree in the yard, occasionally using them as a tether for their livestock. Others let them continue to grow amidst their crops, since they observed that the trees did not seem to interfere with growth of other crops. Others let them grow for the sake of the children who had found the smooth, well rounded kernels useful play items. They also found the opened kernels to be delicious as a snack in the raw form. In the words of Njeru, a farmer's son who is today an agricultural officer, but then a ten year old boy:

> *We knew which farm had the sweetest and highest yielding trees in our neighbourhood, where we used to congregate after school in search of the wonder nuts to the disenchantment of our parents!* (interview 2004)

It is worthy of note that just as with the earlier experiences by the settler farmers (Chapter 2) no local research data were available for this crop. The data became available only after experience in the field in various agro-ecological zones. However, different from the colonial experience, Macadamia was made available to smallholder farmers, owing to the political balance of power at the time of distribution.

In a way, apart from farmers who uprooted their trees, farmers who maintained the trees for one reason or another, had begun just like the earlier settler farmers to engage in a rich and practical information accumulation exercise. This farmer database was made use of by the research institute in a 1977 high yield Macadamia mother tree identification exercise, through the newly established Macadamia research project.

KARI research on Macadamia

A facility for Macadamia nut research within the precincts of the Thika Horticulture station was constructed through Government of Japan bilateral aid to the Kenya government. A high yielding tree identification mission was organised in 1977 in which researchers visited parts of Central, Eastern and Coast Provinces. The researchers consulted the farmers and their families, and particularly the children, in identifying high yielding trees.

After identification, the trees were monitored for three years with the involvement of the farmers who harvested the nuts and recorded their yields. The research scientists were then to collect the figures and take samples for quality analysis. Through this arrangement the 300 best yielders were identified and kernels were obtained from these to establish an orchard of the 30 most promising trees. Seven clones were then

selected from these trees and taken to various agro ecological zones for adaptive trials (Nyaga and Tominga 1996). Four out of seven were recommended for various regions and the remainder - KRG-1, KRG-3 and KRG-4 - earmarked for further observations. Table 2 shows the clones selected and recommendations in relation to site characteristics.

Table 2: Selected Macadamia clones and the site characteristics

Clone	Zone	Temp	Rainfall
EMB-1*	1400-1550m	20-21c	850-1200mm
KRG-15*	1550-1750m	18.5-20c	1200-1600mm
KMB-3	1750-1900m	17.5-19c	1600-2000mm
MRG -20	1400-1550m	20-21c	850-1200mm

*EMB-Embu, *KRG-Kirinyaga *KMB-Kiambu, MRG-Muranga
(Source : Nyaga and Tominga -2004)

Currently it is estimated that 50,000 smallholder farmers have established orchards and produce over 3000 metric tonnes (Table 3) of processed nuts, earning the country an estimated Ksh 400 million (Euro 5 million) in foreign exchange. These are some of the nuts that made the story in the Australian Herald referred to above.

Table 3: Production of Macadamia in Central Province up to 2003

District	*Area (hectares)*			*Production(tonnes)*		
	2001	***2002***	***2003***	***2001***	***2002***	***2003***
Nyeri	*135*	*100*	*100*	*375*	*300*	*400*
Kirinyaga	*263*	*298*	*304*	*1444*	*1638*	*1520*
Muranga	*89*	*89*	*89*	*288*	*311*	*534*
Thika	*223*	*247*	*256*	*476*	*1578*	*1495*
Kiambu	*35*	*31*	*31*	*105*	*124*	*375*
Maragua	*77*	*123*	*133*	*194*	*597*	*636*
Total	**2823**	**2890**	**2916**	**4883**	**6550**	**6963**

(Source: Ministry of agriculture, 2004)

Farmers' partnership with processors

The Macadamia processing equipment was sold to a company called Kenya Nut, which became the sole nut buying and processing company. The company followed up the trees previously planted in the field, and started buying nuts-in-shell. The price offered was, however, very low according to one interviewed informant, who said:

> *We used to get as low as Ksh 10 (11 Euro cents) for a kilogramme of nuts from the company.* (Farmer interviews 2005)

In the 1990s prices improved but a dramatic steep rise occurred in 2004 (Table 4) due to the competition brought on by the liberalisation of nut markets. This occurred

when two other processors joined the fray, after a series of legal duels (so-called 'nut wars').

Table 4: Prices of Macadamia - 2004

Month	Price /kg	Remarks
Jan to Feb	23	Lowest price
March to early April	30	Set price as minimum
April to Early may	33-37	Price rise due to competition
May (late0	40-45	,,
June	50	,,

(Source –Provincial Director of Agriculture- Eastern report 2004)

Three other buyers joined the market, but the prevalent ones remained Kenya Nut, Kenya Farm Nut and Mt. Kenya Nut and Commodities. They all operate in Central and Eastern Kenya and have established collection centres at buying centres where agents accumulate nuts delivered by farmers. Middle men also buy from farmers and deliver to the collection centres. These main processors have provided some extension services to the farmers, in the form of advice on management practices, post harvest handling and grading. The main support has however been in provision of planting materials through nurseries jointly run by various cooperative societies. Two of the companies are described below, to give an idea of how they are organised and how they work with farmers.

Kenya Nut Company

This is a pioneer nut buying company established in 1974, after it was appointed by the government to invest in the development of the Macadamia nut industry. The company started by conducting visits to existing and recently established tree orchards. Farmers were encouraged to tend the trees, upon which the company would buy the nuts-in-shell. Simultaneously the company also established a nursery to multiply specific selections previously introduced and local selections so as to make the essential planting materials available.

Between 1975 and 1977 the company was responsible for the commercial development of the Macadamia nut industry. It multiplied and supplied planting materials to potential growers, purchased, processed and marketed the kernels and other by-products locally and internationally. According to the company manager:

> *The company has spent over KSh 600 million in developing very modern processing/manufacturing facilities, commands a world wide market and maintains a very efficient marketing system which could market much larger quantities than are available annually at present.*

The company has personnel who operate a fleet of motorcycles that traverse the Macadamia growing and buying centres. In the course of these trips, they advise farmers on husbandry practices and also give them feedback on the quality of their produce. Besides buying from the farmers directly through the buying centres, the company also buys from brokers but according to a company executive:

> *The agent/broker system is easy to implement and manage but it has limitations since the processor never gets to know if all the money is paid to the producer. In view of this, we as a company prefer to buy the nuts directly from the farmers in spite of the high transaction costs.* (interview 2005)

Mount Kenya Nut

This company is owned by the Embu Farmers Savings and Credit Company Organization (SACCO) who collectively comprise the co-operatives in Embu District. The company was launched in 2003 and is the third largest processor, with a fully operating processing unit. Lack of a guaranteed market for farmers and the need to own their processing plant gave rise to the foundation of the company. Nuts are collected from farmers through the co-operatives. Previously, the co-operatives used to buy nuts but were not able to process them. Mt Kenya company has seedling nurseries which are licensed by the Horticultural Crops Development Authority and conforms to all the regulations, and employs extension workers who work with farmers. It is also willing to contribute towards research on Macadamia. It possesses equipment capable of processing up to 400 metric tonnes, and process small quantities that sell locally in 20 kg packets. The company also exports raw nuts.

The group nurseries and high demand – to soak or to crack?

On one of the visits to a farmer research group, I found the group members busy spreading out Macadamia kernels nuts on a tarpaulin. On inquiring about the purpose, I was informed that they were trying to establish a nursery. The manner in which the nuts were sourced was striking, in that each member of the group had contributed between 20 and 50 nuts. These nuts were to be raised in one nursery, and once ready for sale they would be sold to members and non-members alike.

This is happening despite regulations that are supposed to be enforced by the Horticultural Crops Development Authority (HCDA), where the fruits and tree nurseries order of 1989 published in the Kenya Gazette supplement No. 58, as legal notice 252, states unequivocally that '*all fruit tree nurseries are supposed to be registered with HCDA before any operations start*'.

The order lists 12 requirements that any nursery operator has to fulfil and for which contravention may earn an operator a one month jail term or a fine of Ksh 1000. Two of the twelve requirements require a fee of Ksh 2000 and an inspection visit by the HCDA staff. Due to their small size of operation and lack of awareness, many nurseries operate without a licence. These nurseries are referred to as *jua kali* nurseries. It is also observed that despite recommendations on proven clones, farmers continue tending old trees introduced in the 1960s.

It is from such trees that the group farmers had obtained their nursery seeds. Each farmer contributed between 20 and 50 seeds from his/her best trees and collectively, they raised 1000 kernels which they hoped to nurse and sell to surrounding farmers, as current prices for seedlings are very attractive.

The seedlings were pre-treated by making a small crack to let water seep in, to facilitate germination. This was as opposed to the official recommendation 'to soak the nuts in water for 72 hours' which some of the farmers who were aware of it termed as a 'recommendation for people with a lot of time to waste'. This group was shown how to use the cracking method by a local or *jua kali* nursery operator who lives 10 kilometres from the group farm. When I found him demonstrating to the group members how to do the cracking, I interviewed him on where he learnt the method, and he told me that he learnt it from another farmer. I asked him what other methods he uses and he said that he has tried air layering (refer to *khat* Chapter 5) but he said that he has not yet succeeded. He also added:

> *A nursery has to be provided with warmth by using mulch of a straw like grass, which gives better results than any other grass or weeds. One has to be careful on the plant materials that they use to cover their nursery because some will provide shade and a bonus in form of troublesome weed seeds which become a nuisance later on in the season*. (farmer interviews 2005)

When I asked him if he has undergone any training in nursery management, he said:

> *I have never gone for training because when I wanted to go I was asked to pay Ksh 2000 and I thought with that kind of money , I could [better] buy all the materials I needed for my nursery and even hire someone to help me. I therefore did not pay and I chose to use the knowledge I acquired when I was a member of a group that was raising agro-forestry tree seedlings.*

When I posed the possibility of the registering organisation (HCDA) referring customers to his nursery and hence help in marketing the seedlings if at all his nursery was registered with them, he told me:

> *I do not think I need to worry about the market currently because there are so many customers who need Macadamia seedlings that many of them make advance payment and sometimes it is difficult to meet the demand. That is the reason why I am encouraging this group to start their own nursery.* (farmer interviews 2005)

On competition, he said from what he had witnessed, it will be long before the demand for Macadamia is satisfied especially now that the companies are offering so much money. He also added that even if the international market was not available local roasting of the nuts at home in a similar manner as cashew nuts was a possibility and some farmers are already doing it and supplying local shops. It is therefore difficult to saturate the market and like we say here, he added:

> *'Cii ruru itininanagira nyeki' (When they are in one herd they do not finish grass for each other* (A local saying meaning that despite their numbers, all the animals in a herd get their share of the fodder).

By the end of my field work at the end of 2005 the group members were putting the seedlings into polythene bags, hoping that in a year's time they too will 'join the herd' of those marketing Macadamia seedlings to members and non members alike. The story tells us a good deal about the way farmers try and break technology bottlenecks, when the price is right. The lesson seems clear. There is unmet demand for cooperative attempts to address technology bottlenecks. The challenge for KARI is to recognise quickly enough where those opportunities lie. But the Macadamia

case also tells us about 'gaps' in the market system. Freedom from market controls meant that more commercial players entered the field, and some tried to provide farmers with technological advice. But the system is evidently not comprehensive. Forming effective public-private partnerships for agro-technology requires some kind of careful overview of opportunities, and a firm but fair regulatory authority to oversee initiatives.

3. Case 2: The case of Effective Micro-organisms (EM) for composting

Setting of the case

In the course of my field work I asked Jane, a divisional extension worker about her opinion of research and the information they received from the research scientists. In response she replied:

> *I think the researchers do not update us regularly because if they did I would not have suffered the embarrassment that I once suffered from a question that was directed to me while attending a seminar in Eldoret I was the only one from Central province in this seminar when someone asked a question about a certain product called EM that farmers are using in Embu and Central Kenya. According to the person, this wonder product is so flexible in its use that it is being used on crops in the fields, in cow sheds, in nurseries and even some people are using it as medicine, and could the lady from Central enlighten us on the same? (*interview notes 2003)

As Jane listened to the questioner, she could not remember at any one time having heard anything like this, and she told the meeting as much. She promised however that when she got back to her HQ she would check and send feedback to the members:

> *It was difficult and embarrassing to admit that I did not know and yet farmers were using it in my backyard and the information had spread hundreds of miles away. When I returned from the meeting, I got the details of the product, Effective Micro-organism or EM.* (interview 2003)

Following this discussion with Jane, I became interested to find out what the product was, and to know how much of it was available in the Embu research centre.
The following are the details that the extension staff member did not have, at the time of receiving the question and which I got through interviews with researchers, with the NGO dealing with the product , and with farmers who have used it.

Effective Micro-organisms: what is EM?

Effective Micro-organisms were introduced by a Japanese NGO called TENRI. It is a product that combines lactic acid bacteria, fungi and yeasts and when these organisms are present in the soil, they stimulate productivity and vitality. The product was discovered by one Professor Teruo Higa, a horticulture professor from the University of Ryukyus in Japan. According to available information, the product

significantly increases production levels, as demonstrated by a 50% yield increase in Japan in the first year when EM was used.

In Embu, the technical staff in the NGO introduced the product to research scientists in the Embu station as a product to control diseases of crops such as tomatoes, beans and other horticultural crops, besides being useful in composting.

The scientists conducted disease management trials, and according to them application of the product did not show any significant reduction of the targeted disease problems and the same happened in the compost trials that were also conducted. As far as the scientists were concerned '*the proprietors of this product were blowing their trumpet too loud'.*

In the meantime, the NGO acquired a piece of land on which it conducted its own tests and found that on various crops the product had positive effects. When they tried to interest the researchers in getting involved in these trials, the researchers were hesitant. The NGO therefore continued with the trials and invited farmers to visit the trials on their station. This impressed some farmers, who decided to buy some of the product and apply it in their farms.

According to one farmer:

> *I was not sure of what exactly was going to happen but when I applied the solution to my tomatoes (in the soil) the results were dramatic. There was an increase in the tomato yields. I also noticed that the manure heap I applied the product to reduced in height rapidly which is a sign of "getting cooked" (kuiva). Added to this was the fact that the offensive smell that used to come from the manure when ferrying it to the field was not detectable. Since then I have been using the product with satisfactory results.* (interview 2003)

After the NGO found that farmers were getting interested in the product, they employed sales persons who went round Embu, Meru and Kirinyaga districts popularising the product. They addressed farmers in churches, markets and other gatherings and initially gave samples for farmers to try. They asked them to each try one aspect of EM, however. Hence each farmer was asked to try, for instance, application on tomatoes, application on compost, cleaning the cow shed in a solution of the product, or even spraying on manure heaps.

According to one technician from the NGO:

> *the farmers seemed very keen on the product particularly after their first encounter with it. They came back for more and others requested us by mail to send some more products to them or talk to them in their church.* (interview 2003)

The NGO appointed agents to stock the products on their behalf in different parts of the region. They also started contacting known industries dealing in products known to have offensive smells. After purchasing initial samples companies ended up making bigger orders, and by the time of these interviews, three large companies (a milk processor, a hides and skins dealer and a flower farm) had already placed

orders for large quantities of effective micro-organisms. In the meantime, farmers who bought the product had various claims to make, after trying the product in various innovative ways.

Pig sties and cow sheds free of offensive smells

One dairy cow farmer group collecting and marketing milk from members used the product to clean its milk sheds and to clean the cow sheds of members' farms. When the present researcher together with some extension and researchers visited some members farms, they were very proud to invite us to see the slurry (manure collection pits) which were free of any smell, and they also alerted us to the absence of any flies around the compound. A dramatic experience was a farmer who was keeping pigs; unlike the offensive smell that one gets in pig sty environments, this particular one had no offensive odour and we learnt from the farmer that:

> *At first I thought that the company agent was just telling me about the product for the sake of a quick sale. However when I followed the instructions the results are as you can see – no smell, and hence I am able to live comfortably with my neighbours. I am also able to comfortably use the manure in my garden and workers are ready to carry it to the field unlike before when the manure would remain in the manure heap despite my appeal to workers to carry it.* (farmer interviews 2003)

Despite all these claims by farmers and inspite of some users being members of farmer research groups, scientists remained unconvinced that the product could play any role in farming.

When I interviewed scientists at the centre about this product one of them told me:

> *I think what the NGO is selling is a concoction of products that they know very little about. They have not published anything about it and when you ask the sales people (technicians), they seem to know very little about the products. The Japanese are so secretive about it and hence we do not want to get involved in something that very little is known about. Who knows - this may be one of those things that are banned in their country and they are dumping it here.* (interviews 2003)

On suggesting that the only way to know about it is by testing it he quipped:

> *They told us that it could control plant diseases but our colleagues found nothing like that when they sprayed and this was done for several seasons. It was also tried in the cow sheds and goat sheds because it was claimed that it could control flies. Instead of flies being controlled they increased in numbers!... Even when used for composting, it did not work and the materials just stayed undecomposed. (interviews 2003)*

I then followed up further, and asked what about the various cases of success reported by farmers, which you could investigate and establish the facts? The scientist said:

> *Farmers can say many things but I still think this product is fake and should not be used since it is not even registered.* (interviews 2003)

This is despite the statement on the bottles of this product clearly indicating that the product has been registered for agricultural use by the pesticides and chemicals board. It was also interesting to note that during the CRAC meeting (Chapter 4) the scientist who did the tests openly declared that he had no negative thing against EM and remarked '*anyway it works*'. This evoked laughter, and seemed to indicate that there was more than met the eye.

On interviewing the scientist who made this statement, he said:

> *Yes, it is true that our tests did not show any significant difference between the treated and untreated plots. However, I must also point out that this may have been due to other factors, since the plots were not artificially infested. In any case, we were comparing this product against an established fungicide.* (researcher interviews 2003)

He then pointed that he attended a conference organised by EM Kenya, and he listened to people who made presentations that talked highly of EM. He particularly talked about a farmer from the Rift Valley who was spraying his wheat with the product and getting very good yields, and another one who was spraying it on rice. This he however hastened to add was perhaps '*a different formulation from the one we tried in the station*'.

Company's claims and KARI claims

Some of the scientists were more open about the whole issue. They said that the problem arose out of a misunderstanding between the company and the centre. The company introduced the product and made many claims about it. They then went to the ministry of agriculture headquarters to seek guidance, since they wanted to have it registered. They were referred to KARI headquarters and KARI headquarters referred them back to KARI Embu, and they were not amused. KARI Embu was asked to come up with a budget for testing, which they did. When this budget was presented to the company, there was hesitancy on the NGOs part, and this marked the end of the process. At this time, lots of farmers were already making big orders for the product and perhaps the reason for the NGOs loss of interest in the KARI budget. Testing after all was to facilitate dissemination following proven performance! Why test if the product was already being used by farmers? There was however a catch since the permit to formally commercialise the product would be on the basis of results from KARI.

However through classification of the product for use in environmental management and not as an agricultural class product, and this essentially settled the stalemate. However, researchers continued harbouring some mixed perception. The NGO staff developed a negative attitude towards KARI staff and this was evident when I visited their premises for an interview with the technical manager. During this visit, the technical manager was rather uncomfortable when I introduced myself as a researcher from KARI doing field research in Embu and who had interviewed some of their customers. The discomfort was indicated by the length of time that he took to usher me into his office and also the guarded manner in which he talked to me once I

got into his office. His answers to me were short and rather blunt and at one time he glanced at his watch and made me feel he was getting late for an appointment. This attitude dramatically changed when I mentioned how impressed I was by the Thubuku dairy farmers' group milk collection centre in Meru, and the odourless compost that farmers were preparing in the farmer research group.

The technical manager opened up and at the end of the interview, he owned up to the fact that since the last encounter with KARI he had a very bad impression of the institute. He added jokingly '*I was even considering not granting you this interview*'.

He then went on to show me round their farm and the products that they were preparing for various customers, and the small plots that they use for testing. He informed me of the order received from flower farms form certain parts of the region. He added that soon they might not even be able to supply the many requests coming from coffee farms, due to concern to develop organic coffee. When I posed the question of the tests conducted between the NGO and KARI, he reacted by involuntarily raising his voice and saying: '*I am not sure of what kind of research is being conducted in this country by KARI*'.
He then went on in a controlled voice to indicate that:

> *It is true a mistake was made in declaring the product to be a curative agent for horticultural crop diseases, but the product is supposed to work by enhancing phosphorous uptake in the soil and hence by improving plant nutrition, the plants tolerate the major problems. The people who contacted the researchers made a mistake and the product was applied and the dismal performance was the results. The results in the farmers' field should however now be used to pass the verdict* (Interviews 2003).

As he explained further, the performance seems self evident in the field and all farmers using it express a lot of satisfaction with the product. For any farmers who are not satisfied, the product is replaced and a demonstration is conducted on their farms. Of the many uses that the technical manager informed me about, he talked of use in compost and manure heaps to reduce flies and hasten decomposition, use in nursery beds, use in toilets and septic tanks, and also mixing with chicken feeds and animal feeds to increase yield performance. Another use is 'EM soup' where EM is mixed with botanical pesticides for enhanced efficiency. For all these uses, different formulations are available in all the company's outlets.

As I left the NGO premises, I got a ride from the company vehicle that was to visit a coffee growers group to discuss the terms under which they would transact business with the NGO. This is because the product was certified to be safe for use in organic cultivation of coffee, now fetching a good price on the world market. In general, while the number of farmers using EM is not exactly known, the truth is that a good number of farmers who try it for the first time do not stop using it. It involves making stock solution using molasses and the farmers are able to process more of the product. This makes the inventory of the users from the company's side a bit difficult to assess. It seemed, however, that farmers have explored all kinds of uses in the farms.

This case study is an interesting one, in that it shows that farmers may be more adventurous in trying out new – and fringe – products than KARI researchers. There may be genuine scientific doubts about whether the claimed effects are achieved, and proper peer reviewed published research clearly has a place in the assessment of such claims. But the story also indicates that in forging effective actor networks involving the triangle of farmers, scientists and commercial operators resolving mutual suspicions between scientists and commercial operators may prove as difficult as facilitation of interaction between farmers and scientists.

4. Case 3: School groups and their potential role in participation research

Setting of the case

In a talk show in 2005 the former US President Bill Clinton told an American television audience that the person he most wanted to meet was President Kibaki of Kenya, '*because he has abolished school fees*, [*which] would affect more lives than any president had done or would ever do*'.
The same line was repeated on BBC News Night by the UK International Development Secretary, Hilary Benn, who showcased free primary education (FPE) in Kenya '*as the shining example of aid to Africa not being wasted*'. (Sunday Times review, 26 June 2005).

According to the Kenya government, every child has a right to primary education, which has now been made compulsory. This started in 2003, as soon as the new government took office and declared primary education free for all children. Despite the high pupil-teacher ratios the free school programme has been ranked highly among many social projects in Kenya.

Schooling is a critical stage in shaping future lives. Schools represent a socio-cultural institution where people become oriented towards their future careers, and their outlook towards life is shaped. This then makes the schools an institution with a potential to impart various life-long skills to pupils. A question posed here is whether the ideals and practices of agricultural research could somehow be imparted through schooling. Agricultural research might intertwine well with the learning of science and biology, while pupils could put into practice what they learn in school in their parents' fields.

A short history of school groups

The potential of the school system to have an impact on Kenyan agriculture was recognised in the 1950s. One of the recommendations of the Swynnerton Plan was to provide agricultural training to students in teacher training colleges who would then teach improved farm management practices to school pupils. The pupils were then expected to teach their parents and friends (Swynnerton 1953). Agriculture was thus

included in the curriculum of the teacher training colleges, and upon graduation, they were expected to teach the subject in both primary and secondary schools.

Agriculture learnt in the classroom was practiced in school gardens where the school pupils and students were allocated plots where they grew crops and raised farm animals. Every pupil in the school was involved but a later approach was to establish agricultural clubs for only those pupils who had an interest in agriculture.

While agricultural teaching was done by class teachers, agricultural officers had a system of adopting a school to demonstrate practical aspects of various agricultural practices. Funds were allocated in the ministry of agriculture budget to cater for demonstration inputs for school plots. As budgets became limited this approach was discontinued and schools had to cater for the activity. It was then left to teachers in different schools to design ways of continuing the activity.

In 1984 Kenya's education system underwent a restructuring, and the 8-4-4 system replaced the former 7-4-2-3 system. The new system placed more emphasis on attitudinal and skills preparation for life after school and the 'world-of-work', and for 'self-employment' in particular. New subjects, such as art and craft, woodwork, agriculture, business education and home science, were added to the curriculum. Schools then had to re-establish their school gardens, and those that had maintained them continued. Based on the size of the school gardens and suitability for experimentation various research centres have used school farms as sites for field trials. Such field trials however concern themselves with the required data but not involvement of the school community and particularly the pupils or students in the work. As one school headmistress said:

> *It is true we do not participate in your [KARI] activities in our school but we see your car coming into the compound and going away and I hope that next time we shall be able to join you in your activities*. (headmistress interview 2003)

Establishment of a trial site in a school follows a procedure in which authority is sought from the headmaster/mistress of the school. The latter informs the agriculture teacher who becomes the contact person. These sites are planted and managed by researchers, who do not involve students and teachers in the trials. Field evaluation and field days are occasionally held, and it is on such occasions that the school is invited, along with community members, to see the technologies being tested.

When the researcher talked with scientists, about the potentiality of the school groups, there were mixed reactions with some feeling that the schools should be sites only and others agreeing that there was perhaps some potential. The reactions expressed above became the genesis of pilot activities with school groups. The aim was to explore the role of function groups such as schools in participatory research. The hope was that observations made would help provide insights for the participatory research process.

Preparations for activities

A visit by the present researcher to the divisional education offices in the company of three scientists and the divisional agricultural officers was the beginning of this school pilot activity. The objective of the visit was to discuss with the divisional education officer - who is in charge of schools in the area - where the proposed work might best be conducted. At this point there was no idea what actual activity might be undertaken. The discussions revolved around the general issue of involvement of school groups in agricultural activities, and particularly in research, as a way of reviving and reshaping earlier initiatives.

The discussions resulted in an initial sample of ten schools, out of which five were to be selected for specific activities. Site visits were then undertaken. On each visits the school plot was viewed and an assessment was made of activities that the schools were undertaking, such as recording where there were agricultural club activities and the number of members involved. Discussions with teachers and members of groups revealed that though many clubs were generally inactive some still raised rabbits. Arising out of these visits, five schools were selected and a meeting to discuss possible activities was arranged. Representative group members, together with teachers in charge, were invited as well as two researchers from Embu centre and the extension officer of the area. In total, five teachers and ten pupils attended a meeting held in one of the schools.

Rabbits and vines

A range of crops was discussed with the agriculture teachers and pupils. An activity that would be simple and complementary to rabbit-rearing was envisaged. The idea of sweet potato multiplication was decided upon, for various reasons. The main one was that this is an easy crop to manage and has multiple uses. Club members were using sweet potato vines, sourced from their homes to feed their rabbits. To plant the vines in the school, planting materials were needed but being a dry season, adequate planting material was not available. It is on this basis that an activity to multiply vines as quickly as possible was decided upon using a rapid multiplication technique available in the repertoire of recommendations in the research centre. The technique made use of finger size vine cuttings. To be able to decide on the suitable nursery methods, a gunny bag and a ground nursery were to be tried in the school gardens and also in their homes where the members agreed to show their friends and parents. It was the hope that once established, planting material might could be sold to farmers and neighbors to earn some extra income. The schools, therefore, were to establish their own material using a rapid multiplication technique to avail enough planting material, even during the dry season.

Discussion around this issue raised a lot of questions form the school teachers. In one instance a teacher wanted to know the difference between an experiment and a trial, and asked the researcher:

I have been listening keenly to you Mr J., and I am not sure if I got you right… I have heard you mention trial and experiment… is there any difference between these two words?

The answer given by the researcher suggested that the two words are used interchangeably, although experiments mostly refer to tests done in the laboratory (for new products and at times processes) and trials are used to refer to tests done in the field to try out what has been found in the laboratory. He ended by saying that there was a thin line between the two terms, but in the context of the meeting the activity being discussed was a trial.

Another teacher asked to be told the difference between an experiment and a demonstration, because he has heard many times the agriculture officer talking about demonstrations:

> *However, whenever I visit these plots I do not see any difference between what researchers have been planting in our school and what the agriculture officers show us.*

The agricultural officer explained that a demonstration was used to display the results of research experiments and trials. He compared this with athletics, where the best candidates are taken to the next stage, until there is finally a world champion emerging from all competitions. This comparison generated quite a bit of excitement, at which point I stepped in and indicated that our aim was to think of what candidates to subject to a competition. The researcher then explained that there were many sweet potato varieties in the research station, but two would be chosen from among the five.

With the joint decision reached to test a rapid sweet potato multiplication technique using two different nursery methods, the researcher indicated that the two nursery methods would be the candidates or players, and the sweet potatoes would be the goals. The work of the players would be to score as many goals as possible, and in this context the nursery to give more plants would be the one to be selected for multiplying the potatoes. This made the scenario quite clear to the teachers and pupils as indicated by the nodding of heads and '*oohs*'.

A sketch trial plan was then drawn and described and the minutes of the meeting were used as the framework for the trials protocol. Five different dates were then agreed upon for visits to different schools to establish the nurseries. Before the end of the meeting it was agreed that the pupils who attended this meeting were to brief their colleagues in the school.

Establishing a race between 'running nurseries'

In each of the schools, group members were divided into groups and each group was to establish a nursery using the two methods. A quick recap of the activity was done using simple interactive methods, where pupils who had attended the meeting were requested to repeat what they had told their colleagues on their return to school.

When in one school the pupil doing the explanation talked about competition by the nurseries, the group members burst out laughing. On inquiring why, I was informed it was because during the briefing the pupil had told her colleagues that the nurseries would compete, and the word she had used in the local language was 'running'; the activity was therefore referred to as the 'running nurseries'.

Each group was supplied with five vines of each of varieties Tainang and Naarspot and shown how to prepare three node cuttings from them. The two nurseries were gunny bag and ground nurseries.

- Gunny bag method: soil put in sack and tied, followed by watering and planting through sticking the plantlets through the sack after piercing holes with a stick
- Ground nursery: nursery beds established on raised ground of fine tilth prepared by hand hoe.

After planting, pupils were expected to expand their nursery, and the group whose vines performed better (in terms of numbers, records and observations) would be given a token prize. The nurseries were established during June 2004. The characteristics of the three of the five schools involved and their groups are described below.

The schools

Githima school

This school is located in a highly populated area of the division, on a six hectare piece of land. It has a total of 400 pupils and its 4K club has 40 members. The club has not been active this term. The lady teacher in charge of the club is also in charge of the school garden used by members of staff to grow their own crops. In the previous term, maize and beans were planted in the plot but C*ynodon dactylon (Couch Grass)* out-competed the crops. The school plot is well positioned and though small in size scope for expansion is large. The club used to be very active in the past but funds to purchase inputs have been difficult, according to the club patron. Innovatively, the members have been asked to bring a few seeds of different crops during the rainy season but failure to get fertilizers and pesticides had been a problem leading to the dismal performance of the crops. The nursery beds were established on June 10th, 2004.

Miembeni primary school

This is a school of 350 pupils. It is on eight hectares of land and the school garden covers two hectares, on which 100 coffee trees are planted. These have been intercropped with beans, and on one side kales and some other vegetables. It has a 4K club with a membership of 24 active members. They rear five rabbits that members feed in turn every day. The school also has a plot of Irish potatoes, obtained from KARI three seasons ago. They have been growing these and selling to neighbours. The demand is very high, and so far they have sold about six 100 kg

bags to the surrounding community. Nursery establishment took place on June 9th, 2004.

Immaculate primary school
This school is located on a 10 hectare piece of land and the school farm occupies two hectares but only 0.5 hectare is available for club activities. The 4K club consists of 35 members, and they have seven rabbits and some chicken. The members feed the rabbits and are also involved in some of the activity in the school farm, though this does not happen regularly. Among the membership was a small group of very playful boys who the teacher kept on imploring to be serious with their work. Surprisingly, these members all ended up in the same group. The project looked like it was going to flop, but things turned out differently. This was the school with the best managed plots of all. At the time of the last monitoring, the plots were well managed and already some groups had filled their plots. The plots were established on June 14th, 2004.

Milimani school
This is a school with 500 pupils s and an eight hectare farm. The school club was started in 1982 and has 40 members and the activities involved are crop cultivation, poultry and rabbit keeping. This is due to the support the club has received from the agricultural office close to the school. Support includes small demonstration kits, donated by companies and other organisations. The demo kits were not necessarily meant for the school, but due to the network connections of the agriculture teacher inputs were made available. The school club is in the process of getting a fresh stock of additional rabbits because most of the the ones they had were disposed off due to inbreeding. The school plot was established on June 15th, 2004.

Bondeni school
This is a school located on the transition between the dry and hot zone of the division and the moist cool Mt. Kenya forest to the west. It stands on 12 hectares of land and has set a side a school farm of two hectares. The club is quite active. The club has 32 members and eight rabbits which are well cared for. Unlike the other schools these are bigger and healthier. They were purchased from a farmer who obtained the breed in a distant district, and they looked quite impressive. The school also has some ducks and chickens, which are used to teach the club members about poultry housing and rearing. The eggs are sold, and some of the money is used to buy inputs for school club activities. The clubs plot was planted on June 16th, 2004.

Nursery trial management

The members of the club were divided into various groups depending on decisions made by the members and the teachers. Each group appointed a group leader and secretary, and the selection criteria were decided by the members. Three of the schools had four groups while two had three groups (Table 5). Each group was to establish one ground nursery and a gunny bag (nylon sack) nursery. Each ground nursery required a bed measuring 1 x 3 m. The raised soil was prepared to a fine tilth. For the gunny bag nursery soil obtained next to the ground nursery was used to

fill the bag, and then the bag was tied at the opening (Figure 2). It was then placed on its side and holes made at intervals of 4 cms between plants and 8 cms between rows.

Table 5: Schools, members, groups and planting dates

School	Number of members	Groups	Date of planting
Miembeni	24	3	9th June
Gathimaini	40	4	10th June
Immaculate	35	4	10th June
Milimani	40	4	15th June
Bondeni	32	3	16th June

Five vines were provided to each group, and using the three node technique the method of planting was demonstrated by the researcher, who planted five plantlets. This was done by pushing the plantlet into the soil and covering two nodes, leaving one node above the soil surface. The distance between the rows was maintained at 15 cm and the distance between plants was maintained at eight cms. One member was asked to emulate the researcher by planting five more plants. After this all the groups went to their respective nurseries and planted.

The nurseries were supposed to be watered at two-day intervals and groups were given small hard covered books to record their observations on dates of planting, watering, shoot appearance, weeds, insect damage and any other interesting observations.

Observations at planting

Group leader selection

Observations made during the planting period were on the manner of interactions. This started with the approaches used by the different groups to select their officers (group leader and secretary). Out of 16 groups, seven selected their group leaders by a member putting forward a name endorsed by the others. The other nine used a secret ballot where they distributed papers among themselves and wrote down a name selected out of three nominations for group leader. The method of picking on certain names is commonly used to select pupils for duties such as being in charge of closing class windows, chalk and duster are in place, and so on. Names are mentioned by peers and the named individuals are given a chance to reject or accept. Three names are always proposed and one selected by secret ballot. In some cases, the nominees are asked to leave the room and the rest of the class selects them by a show of hands. The group leaders were to be in charge of ensuring that the nursery beds were watered, and observations and notes taken down.

Nursery planting

It was noted that members started off in a timid manner, particularly during the demonstration of how to prepare and plant three node cuttings. This changed, however, when members were asked to go ahead and prepare their own plants. The field was then suddenly filled with a buzz from all groups. In quite a number of cases, some group members had questions related to sweet potatoes. In one case, it was asked if the flowers seen on potatoes produce seeds, if these seeds geminate, and then: '*why don't we use them instead of cuttings*?'. The researcher explained that some plants produce seeds that cannot germinate, and others germinate but seeds take a long time to mature.

Another member wanted to know '*what can happen if the plantlets are planted upside down instead of planting the right way*?'. To this question, the researcher asked '*has any one of you ever tried to plant a germinating seed by laying the shoot side down?'*. A member responded positively, but added that the shoot always faces up and the roots go down. The same would happen with the potatoes he was told, but the researcher asked the members to do a small test on the side of the nursery and see for themselves. The teacher at this point moved in and started explaining about the tropisms - where roots always move downwards (geotropism) and shoots always move towards the light (phototropism).

Four of the groups wanted to know why no fertilizers or manures were applied, even though the plants were young. In one case the question was: '*in our agriculture class, our teacher said that the young plants need manure or fertilizers. Why are we not using any manure or fertilizer in our nurseries?*'. The researcher explained that sweet potatoes do not require manure or fertilizer, although sometimes in the nursery it is possible to use some. He had decided just to restrict the nursery to soil and water for all groups to keep the activity simple. He added that manures and fertilizers cause fast growth of vegetative parts without adding much to the tubers. One member then added that in their home her mother planted sweet potatoes in a plot that had been used for planting onions the previous season and the potatoes '*grew so big…'* (using hands to show how big) '*that three were enough for our family of five people*'. The researcher explained that this was due to the remainder of manure or fertilizer from the previous onion crop being used later by the sweet potatoes. He said that from studies they had conducted on-station and elsewhere it is not economical to apply fertilizers.

In one of the groups a question was asked: '*Can we plant maize using cuttings like sweet potatoes, because I have seen my mother uprooting young maize and planting somewhere else?'* (giggles from other members).

When the laughter died down, the researcher asked the members to name different crops that can be established using cuttings. They named sweet potatoes, cassava, grass, Napier Grass, some trees and some flowers. He also asked them to name plants established using seeds, to which they answered maize, rice, beans, fruit trees tomatoes and cabbages, among others. He explained that there are many ways of establishing plants, and that vegetative propagation was used for plants producing

few viable seeds. He explained that in most cases plants producing many viable seeds tend to lack the ability to grow when cuttings are used to establish them. So the answer to the question is: '*maize cannot grow if established using a cutting… however (*he added*) transplanting is different from using cuttings'.*

Many other questions were asked and the researcher asked them to write down any other questions that they might have afterwards so that he can answer them when he comes next time.

A session before discussing the observations in the plot in which members asked questions and the researcher answered them, with other members encouraged to answer if they knew, or had any relevant experience to add, became a feature of each of our visits to the plots. This session was also used as a chance to ask questions to the members about how they organised the group, and what happens whenever they visit the nurseries. Eventually, the discussion would drift to the nursery and the observations made between the last visit and the present visit.

Observations in the course of the season

Across all sites and for all groups, the nursery beds were not impressive to start with, and particularly the gunny bags. The researchers were very concerned about this, and it almost threatened the whole exercise. Fortunately this worry did not last, since soon beds improved An interesting thing was that on several occasions I had to make the trips with some other person from the station. This was because of the researcher's many other duties. This meant a variation in the pattern of interaction, but I also realised that it was a chance to make further observations on what takes place with farmer groups. The researchers are not always able to go to the field as required and the farmers have to deal with different researchers and technicians at different times. One person who is always with the farmer is the front line extension worker. In this particular case he was always available and this was also encouraging because he was able to provide answers to questions raised, while also being very conversant with the local environment. The extension worker often added to the researchers' answers and explanations, by using examples from the neighbourhood and referring the members to the field of 'so and so' beyond a certain hill, or to an activity being conducted by another group in the area.

In the course of monitoring it was observed that nursery beds were in general performing better than the gunny bags. This problem was attributed to water logging, due to daily watering. This was not the case in two of the schools located in the dry zone of the division, however. The gunny bags here were better than the ground nursery. This comparative information was apparent to the researcher, but not to the groups. Communicating results from the entire experiment is a challenge for participatory research initiatives.

When the groups were asked about the lessons they had so far learnt the first group talked about the performance in the ground nursery and the gunny bags and

observed that ground nursery had a superior performance. They also noted one gunny bag had more soil and a better performance than the rest of the bags.

In 12 of the groups, they established a weekly watering regime for the ground nursery and a fortnightly watering regime for the gunny bags. This was done on noticing what was happening, without necessarily waiting for instructions to be given. The groups reported their modifications during a monitoring visit.

Other observations were that there was no weed growth in the gunny bags, compared to the ground nursery and that variety Tainang grew faster than variety Naarspot in both gunny bag and the ground nursery. These differences in performance closely followed the shooting rates shown in Tables 7, 8 and 9 and Figures 1 and 2.

At the beginning of the nursery establishment, it was explained that new plantlets had to be established using plantlets from the same nursery. To do this, the members were supposed to wait until plants had reached a size of about 15 to 20 centimetres from which they could obtain several three node cuttings. In nine groups (56%) an unexpected activity happened. They started new establishment using shoot tips rather than waiting until stems had formed. On discussion with the individuals in the groups, we were informed:

> *When we were shown how to prepare the plantlets, we noticed that the shoots that did not have hard stems were left on the ground and when we were asked to do a test on the side with plants "on their heads" (referring to the upside down test mentioned earlier), we also planted a few of those succulent shoots. They did not dry up and instead established and grew faster than the others. We therefore decided to use this method besides the other one. This is why our nursery has filled up faster than all the other nurseries.*

Another group explained that they observed that the shoots left lying on the ground did not dry up immediately even after the leaves had dried. They therefore decided to include them in their plots, and upon sprouting they realised that expansion of the nurseries could be done immediately shoots started forming. Other members said they also had tried establishing these shoots and plantlets in their homes and had already established nurseries for planting during the coming short rains.

The researcher had no experience on this, and thought it was an interesting issue for a trial in the station and which could perhaps lead to a new approach to the three node technique.

Another observed modification was that in five groups (31%) there was pruning of leaves from the shoots, an activity not mentioned at the time of demonstration. This led to a more uniform establishment than cases where leaves were left intact. This was explained by the researchers as due to the reduced transpiration rate. The idea came to the group because they needed leaves to feed their rabbits!

Three groups (19%) also 'inadvertently' applied fertiliser (or was it in fact deliberate?). The fertilizers were applied after the shoots started forming and this led to enhanced and luxuriant growth. In one case however, it led to scorching of some shoots, and follow-up showed that this group did not water the plants after applying fertilizers.

One group also protected soil in the raised bed using timber and hence maintained the depth of the soil. Good performance resulted, and expansion of nursery was spontaneous.

In one of the schools, the ground nurseries looked miserable after establishment while the gunny bags were thriving. At first the soil was suspected to be poor although the soil in the gunny bags was derived from the same site as the ground nursery. This situation was reversed when the rains came, upon which the ground nursery grew luxuriantly and the gunny bags became weak. It was then realised that the problem was that the ground nursery was not getting adequate water, while the gunny bags were getting and conserving water. This became a problem, however, when the rains came and the gunny bags retained too much water. This proved the point that the gunnys were good in cases where water was a problem. Apparently, in this school, the issue of changing the watering regimes did not surface, unlike in the other schools.

A teacher from a neighbouring school visited this school and expressed interest in obtaining these sweet potato materials, and I left arrangements between the two school teachers under way to provide the materials and the information, courtesy of the school club master.

Use of data from nursery and a link to class room concepts

At the beginning of the exercise teachers of mathematics, geography, home and general science in the respective schools were invited for a meeting, and the impending pilot activities were discussed. After a description of what was proposed, and the data to be collected, the teachers were asked how the activity might be of use to their subjects. Apart from the science teacher, the rest thought not much would be useful because, according to one mathematics teacher *'counting was not a problem since the members knew how to do that and same applied to addition and subtraction*'. A geography teacher thought that apart from the direction of the nursery (East-West) and perhaps the origin of the sweet potatoes, which he thought important, he did not think other issues were very applicable.

On further discussion, using a hypothetical example of possible data from the plots, it was illustrated to them how these might be used to show clearly in a table how the different nurseries performed (Tables 6-10 Figures 1-2). It was illustrated that rather than just showing absolute counts the same figures could also be expressed in percentages and depicted using different types of graphs and ratios. All these

concepts are normally taught in abstract terms, but by using them in a real life situation they would become real and easier to understand.

On the issue of geography, the concepts of environments and their suitability featured. As a result of different environments, the sweet potatoes would perform differently, or at least they might require different treatments. This was confirmed by the extension colleague, who gave examples of how in the upper (tea-growing) zone of the division potatoes suffered different problems from the ones in the lower areas, due to climatic conditions. As such, the plots could be used as a source of information to illustrate aspects of the kind of environment in which the school found itself. Additionally, club members would be able to keep a simple weather chart to help explain why the crop was behaving in a certain way.

On home science, the nutritional value of sweet potato leaves and tubers were discussed and what other crops that could be used together with the potato. The different dishes that could be prepared using the sweet potatoes were discussed and it was agreed that the divisional home economics staff would visit the school and demonstrate how to make these different dishes once the plots were ready for harvesting.

For the science teacher, the lessons were applicable in many ways. Concepts ranging from soils, water requirements and necessary growth conditions besides others were all discussed.

One thing that was quite interesting was that while agriculture and science are very close, the teachers were at the end of the discussions very open about the fact that they had not at first seen these direct relationships between the subjects. As was observed in the course of the season, what started as an interest for a handful of 4K club members ended up being useful to the whole school, as shown in the following account.

We need more plots

Following these discussions, the teachers became interested in the nursery plot activity, and every time that data was collected, teachers would discuss it with the club members first and later with other pupils in the class room. In three of the schools, candidates who were to sit for the end of year examinations used the plots for some of their revision. According to the class teacher the plots made the pupils ask questions that were earlier on difficult to frame, but using the plot it seemed to trigger questions in the pupils (interview 2004).

Another development, surprising to me, and completely unexpected, was the interest shown by the parent teachers association of one of the schools. This became apparent in a discussion with the headmaster. He informed me the management of the school was so keen on the activity that they were planning to expand the area of land the club was utilising in the hope of allocating every class a portion for their learning. He

had been asked by the PTA if the research centre could provide some more planting materials - sweet potatoes and also other crops. At that point we discussed how the techniques learnt might cater to this demand, with club members multiplying enough for the whole school, and also for neighbouring farmers. This was even considered a possible source of revenue for the school. From information received subsequently, the school has indeed become a supplier of sweet potato vines to the rest of the local farming community.

Tables 6-10, together with Figures 1 and 2, show the data collected by one of the schools, and how it was used to illustrate bar graphs first to the members of the clubs and later to other pupils in the school.

Table 6: Varieties and plantlets by nursery types

DOP 9.6.04	**Ground nursery**		**Gunny bags**	
	Naarspot	Tainang	Naarspot	Tainang
Group Grace	20	20	20	20
Group Rose	20	20	20	20
Total	40	40	40	40

Table 7: Observations on sprouted plantlets at various intervals

Group name	**Ground nursery**						**Gunny bag nursery**					
Variety	Naarspot			Tainang			Naarspot			Tainamg		
Days after Planting	5 DAP	13 DAP	Ttl	5 DAP	13 DAP	Ttl	5 DAP	13 DAP	Ttl	5 DAP	13 DAP	Ttl
Group Grace	12	5	17	14	3	17	7	5	12	10	6	16
Group Rose	13	6	19	12	6	18	6	8	14	12	5	17

Table 8: Percentage sprouts of Naarspot and Tainang at 13 days planting (DAP)

	Shoots/plantlets x % (Naarspot)		Shoots/plantlets x % (Tainang)	
	Ground nursery	Gunny bag	Ground nursery	Gunny bag
Grace	17/20x100 =85	12/20x100=60	16/20x100=80	17/20=85
Rose	19/20x100=95	14/20x100=70	18/20x100=90	18/20=90

Fig 1:Narspot in ground and bag nursery

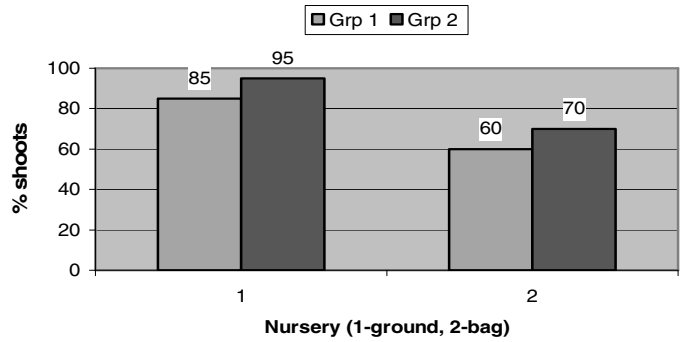


Fig 2: Tainang ground and bag nursery

Table 9: Sample notes recorded by the groups

Date	Notes
30.6.2004	-All plantlets had shoots in both ground and bag nursery but some had dried up -Shoots in nursery had a height of 4cm for both Narspot and Tainang -In ground nursery, Narspot is doing better than Tainang while in bag Tainang is better
9.7.2004	-in ground nursery there are a lot of weeds but none in the bag nursery

Table 10: Sample weather records

Date	Morning	Afternoon
9.6.2004	Sunny	Sunny
17.6.2004	Drizzle	Cloudy
12.8.2004	Cloudy	Sunny
18.10.2004	Drizzle	Sunny

By 18th October, a total of 1250 Narspot vines and 917 Tainang were transplanted from the nursery to the school fields, out of which 500 Narspot and 300 Tainang were provided to various members and teachers to multiply in their homes. Output from the school plots were to be used as input to future potato multiplications in the area.

Table 11: Total cuttings obtained from all schools

School	**Potato variety**		**Vines given out**	
	Narspot	Tainang	Narspot	Tainang
Githima	283	210	100	60
Miembeni	165	189	100	60
Immaculate	232	175	100	60
Milimani	269	132	100	60
Bondeni	301	211	100	60
	1250	**917**	**500**	**300**

The children proved to be very curious and keen. The type of questions that they freely asked and extra interventions in which they engaged can be seen as evidence that they were gripped by the approach. A simple point follows – experimentation has to be taught. Participatory experimentation will depend for its spread on being taught early and widely enough to feed the curiosity of a future generation.

5. Conclusions from the three cases

In the Macadamia case, farmers were provided with a cash crop which disappointed them due to first assumptions that Macadamia trees could be easily transferred from Australia to Kenya. Farmers were supplied with a new crop whose agronomy was not very clear. Thousands of seedlings were distributed country wide irrespective of agro-ecological zones, and the results were disappointing. This approach is typical of the Transfer of Technology approach, which tends to neglect context. Even so, farmers did not give up on the trees entirely, owing to the actions of certain members of the family (i.e. children). They became actors converting parents' actions and a government Macadamia project to their own interests (cf. Latour 1987) and by so doing helped to keep alive the possibility of renewed parental interest in the crop The trees were, in fact, compatible with other farm household livelihood enterprises, so farmers did not grub them up but continued observing them in the course of their other activities. Macadamia trees were no different from many other minor crops or animals that farmers tend in their farms, hoping they will one day come in useful. One farmer invoked a local saying: *'a string in the compound will one day tie something'*.

A change in marketing conditions, and entry of competing purchasing businesses then re-ignited the innovation process. Research services were provided. Information collected over the years by the children and their parents helped researchers to identify high yielding trees (Nyaga and Tominga 1996). These were then used to produce the seven clones recommended for various zones of the country. In actual fact the trees returned to the zones in which they were collected from, now in a commoditised form. Material from Kirinyaga became KRG- 15, clones from Embu became EMB-2, and those from Muranga became MRG -20.

The processor who initially set the ball rolling enjoyed a monopoly and paid low prices, but following a legal tussle, two others joined in and prices rose healthily. This triggered farmers to engage in an activity, even if nuts were then prematurely harvested thus lowering the quality. The adverse effect on their business brought the processors to the negotiation table to seek a solution which they felt ought to come from the ministry of agriculture. The ministry promised to look into the matter but nothing much happened. The processors therefore realised that the only way was to continue working with the farmers by providing feedback to them to reduce deleterious practices. This was done by showing that both the farmer and the companies will be the losers eventually if poor produce drives out good. In the course of this activity around quality, and due to high demand, farmer groups became motivated and hence started to establish nurseries. Social energy was galvanised, causing more farmers to get involved in the cultivation of the crop. Cultivation of Macadamia is a labour extensive activity, and hence its labour requirement is handily spread out once the tree is planted, making its maintenance costs low, unlike some other enterprises. The tree has a lot of uses, some of which are yet to be fully explored. Farmers have a long way to go before fully realising this potential, but the case illustrates that innovation is a process not an event. .

In sustaining an innovation process, the Macadamia case illustrates that farmers draw on a lot information derived from wide experience and interaction with the many different crops and technologies represented in their farms. This case is a clear illustration of how and why researchers need to combine scientific knowledge and techniques with farmer knowledge, if an innovation process serving local needs is to be sustained. It also illustrates the potential that becomes realisable when other players such as marketing companies become engaged; farmers are willing to work with any provider who serves their many and varied needs. However, the case also illustrates that farmers are not easily pushed around, because they have to participate in a number of parallel innovation processes, and tend only to take up those that do not conflict with the existing ones. In the case of the Macadamia nut, the tree co-existed with the other trees, and found a niche with children, long before it filled a void created by recent deterioration of world coffee prices.

The EM case draws attention to the rapid spread from farmer to farmer of products or processes judged useful by farmers even when they fail to convince the research and extension system. The case also shows how science can be used in a quasi-regulatory manner, even to the point of of making it appear products in use may not

be legal. The initial tests done by the researchers gave negative results, but rather than question whether the testing was fair or rigorous enough the tendency was to discontinue the tests. The case seems to illustrate tensions based mutual suspicions between researchers and NGOs. Farmer enthusiasm for the product should perhaps have over-ridden these tensions, leading to more thorough testing and definitive conclusions about whether the technique worked or had harmful side effects. Tensions often exist in government research services between regulatory functions and research activities supportive of innovation (Maat 2001) KARI is thus no exception. But the case illustrates the need to clarify the two roles, and to keep them separate.

The schools case study illuminates some of the hidden potential to create a 'client base' for participatory experimental approaches to agricultural improvement. Through hands-on experience in plots and interaction with researchers and other pupils in an environment outside the class room pupils were able to learn from each ideas and skills able to shape them as potential users of experimental science. The teachers were able to use information from the plots to teach certain class room concepts. The researchers were able to get data from the plots and particularly to engage in discussion with children who were found to be more open as a group than adult learners.

In some schools, the children went ahead and experimented with succulent shoots and it turned out these were as good as the cuttings that the scientists had recommended. This was a 'bold' / 'innocent' modification to the instructions given by the researchers. The researchers admitted that it opened up a technical possibility about which they had not thought previously.

As for the two types of nurseries, the members concluded that while both nurseries had their advantages each had its own disadvantages. The ground nurseries needed to be watered in the dry season and also weeded in the wet season. The bag nursery did not need a lot of water, and did not need weeding. However during the rains it was subject to water-logging. It was also discussed in the groups that filling the bag required some extra labour and space was limited for expansion, unlike the ground nursery. Sweet potato variety Tainang was more suited to the bag nursery while Narspot was more suited to the ground nursery. All this was information researchers did not have and thus there were gains to both sides. Participation led to mutual learning.

Some club members have since established nurseries in their homes and compare them with group nurseries. Many school children have expressed interest in joining the 4K club. Some neighbouring schools have expressed interest in starting their own rapid multiplication activity, and plans are underway to have the initial participating schools serve as the resource schools from which planting material and instructions can be sourced. KARI will in this case play a backstopping role.

The case illustrates that in the right conditions schools can be mobilised as effective players in participatory experimentation. Kiptot (2007) – examining the case of agro-forestry - concludes that adult groups formed for a variety of participatory development purposes have not always been effective in researching adaptive technology options. The results presented in this chapter suggest a different conclusion. Not all multi-purpose or function groups are ineffective in fostering participatory experimentation. In particular, there is potential for experimentation among school 4K clubs. KARI should probably seek to set up a school liaison project to further test and expand upon the promising results just described.

CHAPTER 7

CONCLUSIONS

MAKING HOLES IN THE FENCES AND OPENING THE GATES?

1. Introduction

This thesis has looked at the historical development of the Kenyan National Agricultural Research in terms of the continuity and discontinuity of its institutional structures and this constantly changing context has affected the way in which research has been carried out. The history of the institution and the way the researchers operate are inter-related. Together they explain KARI's current operations and, in particular, the way in which KARI has integrated participatory approaches in its mandate and activities. The study brings out these current practices and shows that, despite the 'space' that exists in the structure and functioning of KARI, 'participation' with small-scale African farmers is sub-optimal. One important contributory element appears to be the way in which researchers view small-scale farmers as 'clients' or recipients. This view of the small-scale farmer contrasts the experiences of technical and social innovations made by the groups of farmers studied in this thesis. The farmer innovations in this research show the capacity of farmers to experiment within their context and contradict the (continued) misconception that farmers need always to be provided with innovations and instructions from the research centres. Rather, these innovations and information (not instructions) from the research centres should be seen as playing a complementary role in improving farmers' agricultural production practices. The final chapter of this thesis briefly reviews the findings of the study and integrates them into an argument for more effective participatory agricultural research.

2. KARI history: continuity and discontinuity

Shift in clientele and related perceptions about their capacity

Analysis of the history of the Kenyan Agricultural Research system shows a picture of a research organisation that started in 1903 essentially as a *provider of research services* to the white settler farmers. These settler farmers had a relatively favourable, homogeneous farming system in terms of soil conditions and geographical locations. They relied on the strategic and applied agricultural research conducted by the colonial research and extension department. The results of the research were then adapted by the settler farmers who also boldly experimented by themselves, developing their own technologies or innovations, as described in Chapter 2. The researchers and farmers interacted in collecting and sharing information, as for example in the case of the inventory on occurrence of tick borne diseases and performance of various crop varieties in the different environments. Researchers

used the results of these interactions and experiments to guide the direction of the strategic/applied research activities. Colonial reports and records indicate that this model of technology generation and diffusion was an effective way of using a small contingent of researchers to support a vibrant export agriculture. This continued until World War I, which disrupted and led to the discontinuation of what has been referred to as a 'small-scale and straight-forward agricultural research system' (Mbabu et al. 2004). The war led to a virtual cessation of agricultural exports with surplus production being absorbed by the military and European staff deployed in the war effort, and African labourers joining the carrier corps. The effectiveness of the research system was attributed to the openness of researchers to suggestions and experiences from farmers and the recognition that the research system gave to European settler farmer experimentation and practical experience. This model was largely borrowed from the Western world. One contributory factor to it working well was the similarity in the epistemologies of the farmers and researchers, which led to a reciprocal relationship.

A major discontinuity occurred when researchers shifted their focus to the small-scale farming sector, at the instigation of colonial policy following political upheaval in the country. Whereas the research staff recognised the adaptive capacity of the European settler farmers, this recognition was not extended to small-scale African farmers. This was reflected in legislation, the domination of farmers' practices and the use of exotic rather than indigenous knowledge, technology and germplasm as a starting point for agricultural improvement (Chapter 2). Non-adoption by small-scale farmers of the improved technologies initially only re-enforced the researchers' attitude, that majority of the farmers were ignorant and incapable of understanding the benefits of the improved technology. This negative perception has in most cases continued and explains the arrogance of researchers who consider themselves as the providers of superior knowledge and technology.

A duality in mandate and practice

The efforts of the agricultural research and extension services to work with progressive farmers and promote a transfer of their improved practices to small scale farmers, at times through coercion, is in line with this attitude towards local practices. Many policy documents (GOK, 2004, GOK, 1966, 1973, 1978) provide evidence of the attempts that were made to change practices and introduce improved technology among small-scale African farmers. While the researchers continued to ignore or did not have the skills to accommodate the adaptive capacity of African farmers, they directed a lot of effort to the 'progressive' farmers and the large-scale commercial farmers who readily took up the improved practices since they had the means and the strategies matched their commercial objectives. The TOT paradigm further entrenched this approach and, since politically-defined national and regional targets had to be met, coercion and later incentives were used to influence adoption of the improved practices. Over time, this led to a disdain for the administrators and the extension staff as well as dependency on handouts.

The Kenyan agricultural sector developed into a dualistic system, with on the one hand, settler farmers, who transformed themselves into large-scale commercial producers and small-scale 'African' farmers on the other. The Kenyan Agricultural Research system was responsible for meeting the needs of both these groups, but related to them in two distinct ways. In the case of the large-scale commercial producers the researchers considered themselves as service providers, but in relation to the small-scale farmers they considered themselves as 'instructors'. There has been a tendency to direct a large proportion of resources (financial and personnel) towards the commercial farmers, justified on the grounds of their contribution to the national economy. This is in tension with the stated objectives of the 5-year development plans of the national government ever since independence in 1963 all of which point to the importance of the subsistence sector for the nation's economy and place particular emphasis on the development of formerly neglected African areas (see Chapter 2). In addition to this imbalance in policy implementation, there is a lack of experience on how to handle the complex smallholder farming systems. This situation has therefore introduced an invisible split in the operations of the Kenya agricultural research institute, as it tries to cater for both farming groups. As a result we see a scenario where the research station gates allowed a two-way flow of information in pre- Swynnerton days, but a one-way information flow ensued in the case of the African smallholder farmers. Thus the colonial research system - while it had its own shortcomings - provides lessons that could be emulated pertaining to reciprocal working relations between farmers and researchers and acceptance of each others' points of view, thereby providing for a smooth transition from adaptive to applied research and vice versa. One pre-condition for this occurring in practice is that researchers (and others) recognise and acknowledge the knowledge and capacities of farmers. Their innovations, as illustrated in a number of cases in this study (Chapters 5 and 6) show that such recognition is justified.

A shift to the participatory paradigm?

Prior to independence many efforts were made to address the apparent disparity in the provision of services. Since independence these efforts have been characterised by the significance of donor funding in influencing priorities (Chapters 3 and 4). Hence, we find increasingly that the KARI system implements projects and strategies in line with donor recommendations. Obvious examples of these are the farming systems and participatory research approaches, introduced in the 1980s and 90s. These approaches principplly recognised farmers' capacities and advocated_closer relationships with farmers, that went beyond the ones with the 'progressive farmers' (see Richards 1989, 1994, Collinson 1982, Biggs 1989, Bentley 1994). After some initial resistance from researchers and some managers, the approaches were 'officially' introduced to the regional research centres. In a sense this was almost a replay of the Swynnerton plan era, the new policy in the 1980s, guided by the 1979-1984 government development plan, stated that a shift had to be made to focus efforts to smallholder farmers. Various actions were taken to implement this policy directive

which put into place structures and procedures like the NRELC, the RREAC, DFSTs and CRACs (Chapter 2).

In essence, one would have expected this to work well since the participatory approaches recognises the adaptive capacity of the farmers and his would lead to technologies being effectively improved, so as to better fit the local context of the farmers. Empirical evidence (Chapter 3 and 4) indicates however that all that changed was the terminology and the operational structure of the organisation, in terms of the location and mandates of the research station. Little changed in terms of the ways of working. There was a shift from commodity to national research stations and from general to regional research stations but the research operational procedures remained intact. Adaptive research continued to be conducted in a manner reminiscent of the old general investigation stations, with the difference being a change of site - from on-station to on-farm. Thus there was only a partial change in the way of doing business and the operationalisation of new procedures and context enabled a continuity of the previous way of doing business. One would have expected a different picture to emerge if farmer adaptive capacities had been viewed positively and incorporated into the research process. The expected increases in the effectiveness of applied research process did not come about, as shown by empirical evidence from various studies and reports (GOK, 2004, Kungu and Mwania 2000, Kodhek 1990). Thus this thesis argues that many participatory research practitioners still form a group that is separated from the farmers symbolically represented by KARI's 'fences' and 'closed gates'.

Evidence suggests that participatory research practices in KARI currently take the form of the contractual/consultative kind (Pretty 1994) blended with elements of the conventional linear approach. This is partly influenced by researchers' academic backgrounds, donor requirements and research policies and mandates. This is evident right from diagnosis, planning and implementation phase where the researchers control the process (Chapter 4). Attitude did not changes with a re-labelling of the projects, confirming Gupta's opinion that methodologies cannot be expected to instil participatory values in individuals unwilling or unable to undergo the necessary changes (Gupta 1989). One interesting display of such unwillingness was the resistance exhibited by the research managers to the introduction of farming system research. This resistance is indicative of the researchers' perceptions of the limited capacity of smallholder farmers to become involved or participate in research, a curious echo of the very same doubts expressed by colonial staff on the capacity of African farmers to be involved in research and other economic activities.

Agro-ecological reorientation but continued socio-cultural misfit

In addition to a lack of awareness about farmers' knowledge, there was a lack of understanding about the differences between on station research and farmer livelihoods. The agriculture department staff assumed that the establishment of 'general investigation' stations for adaptive testing provided representative sites of the agro-ecologies of African farming areas and assumed that a 'cut and paste'

approach could work (see Chapter 2). Thus, research carried out on a crop at a particular station such as Embu, was assumed to yield results that would be applicable to the entire region covered by the station. These general investigation stations have today become the regional or adaptive research stations, which are spread out over the eight provinces of the country, They work together with accompanying sub-centres and testing sites (Chapter 2). Ideally, this arrangement should have solved a number of problems, but a total disregard of practices, socio cultural differences and other so-called 'non-technical' issues prevailed. Differences between stations and farms were never an issue in research done for (and with) settlers, and later for large-scale producers, but they became of paramount importance in the work addressing the needs of small-scale African farmers. Differences between the reality of the station and the reality of the farm, and local differences from one place to another, even from one farm to another, rendered the assumption of uniformity and one-size-fits-all recommendations impractical.

3. Institutional project procedures

KARI has now established research operational structures, procedures and contexts that are more amenable to embracing the views of its stakeholders (Chapters 3 and 4). These structures and contexts include the geographical locations of the research stations, with well-defined structures for stakeholder involvement in the research planning process. These include the Centre Research Advisory Committees (CRACs), Regional Research and Extension Advisory Committees (RREACs) and Regional Steering Committees (RSCs) which organise joint activities such as diagnostic surveys, field days, open days, shows and farmer centre visits. These structures provide excellent spaces for engaging farmers as partners in dialogue in the research process to enable researchers to incorporate farmer feedback and better address their priorities. Largely these changes provide the conditions for more participation by farmers, in the adaptive phase but necessary skills, enabling policies, logistics as well as a vision and a will to arrive at the envisioned situation are all called for. Indications are that there is a small group of individuals who are seen as 'champions' with a vision for participatory approaches (ch 4 and 5).

There is need for closer analysis of this group in order to understand their vision, drive and competences. They could be crystallisation points around which larger groups in KARI organise their work with farmers, and as such in creating critical mass, generating expertise and feedback of information. These researchers seem driven by their genuine commitment to support small-scale farmers, though other drivers/motives can not be ruled out. They go 'the extra mile' by using existing operational procedures and weaving them with their own ingenuity to engage effectively with farmers and their activities. This apparent successful engagement with farmers confirms that there are conditions in KARI for practicing participatory research. These champion-researchers may have realised the futility of working with farmers in the conventional way, where the farmers are instructed and this leaves no room for their creativity. These individuals who seem to be exceptions within the institution have metaphorically speaking made 'holes through the stations' fences'. This comes at a cost to their own reputation by fellow colleagues who consider them

as doing good work but more oriented to extension than to 'science'. Given this tendency, it is valuable to better understand the effectiveness and impact of the work of these 'champions', and how they arrived at working the way they do with farmers. These researchers are engaged in long-term relationships with the farmers involved in research projects set up by donors. This contact between the 'champion' researchers with the farmers often continues, in different forms, long after the projects are phased out. Many interviewees in the study area, referred to the ongoing contact that farmers had with these 'champions'. The mode of interaction between the two groups speaks volumes of the high regard with which each group of actors holds the other. The farmers feel able to openly share their worries about and experiences with technologies with these researchers. It is also evident that research managers partly and/or tacitly recognise the abilities of these champions, for they are the ones assigned with farmer-related tasks, such as participating in farmer fora, shows and field day committees. In this way, the champions play a public relations role on behalf of the centre manager, forming a bridge between the institution and the farmers. Yet, this does not stop research managers from 'demeaning' the contribution of such individuals in the research process as depicted by a reference to there being *no room for failed experiments in research* (Chapter 3). Understanding what makes such individuals effective in their relation with farmers, and increasing their numbers (either through training or recruitment policies) could help KARI to open its gates more widely to farmers and to increase two way flows of information.

4. Adding to the duality: multiple roles

The continuity in the mandate of KARI in a changing context of policies and expectations gives rise to two important points of tension. First, the core business of KARI continues being 'to develop and validate improved technologies' (KARI strategic plan 2000-2010, 2005-2015) for both commercial large-scale producers and small-scale farmers. This means that research practices still largely remain the ones for 'basic' and 'strategic research' and the resulting products, i.e. technologies being validated in farmers' fields. The expectation is that farmers will use the products of this research but, as a research organisation, KARI has no specific mandate to diffuse the results of its research. However, as discussed earlier, participatory research with farmers has added an inextricable role to KARI where the out-scaling of technical innovations can not be separated from joint testing. The second source of tension lies in the policy objectives spelt out in various research and Ministry of Agriculture documents. The strategy for revitalising agriculture launched in 2004 (GOK 2004) and the Institute's strategic plan attest to the wish to target the smallholder farmer. In practice KARI also needs to align with the national policy agenda regarding economic growth and the international donor agenda also has a strong influence via the requirements related to funding. The result of all these forces often means that in practice small-scale African farmer agenda is often ignored (Chapter 4). These competing and sometimes conflicting demands places the institute and its business in an ambiguous situation.

The ambiguity is further deepened by researchers' professional and career aspirations that are related to a reward system that emphasizes publications in

journals and other outlets above other achievements. These outlets are often not accessible to the farmers who are the targets of the institute. At the same time, contextualised results of jointly developed technologies are generally not of interest to these journals that have traditionally emphasised scientific output of wide and universal application. The situation is however changing as more outlets for contextualised research and experiences come on stream but journals with the highest citation rankings remain focused on pure and applied science rather than reporting (highly contextualised) on farm experiences. Work that will not earn points to scientists in the evaluation criteria is bound to be ignored and this consideration can override any other, including the farmers' wishes and aspirations. This situation is understandable for strategic and applied research although the interlinkage with adaptive research is expected and this would be more likely in a collaborative to collegial participation (Biggs 1989).

The ambiguity of roles and mission of KARI mentioned earlier on is acutely felt by KARI managers, at both the headquarters and in the research centres, who have to deal with the competing demands of donors, the government, and farmers. They accommodate the government policies relating to production goals, national food security and the projected impact of agricultural research (Chapter 4). The directors also receive the donors, coming in with their priorities, most often sanctioned by the parliaments of their respective countries, and commitments defined in terms of project objectives. Only through aligning KARI's work to meet these donor objectives, can financial means be accessed. Yet, these are the same, and sometimes the only, resources available to meet the operational costs involved in meeting the government's goals. Obviously the goals of the donors, the institute and, by extension, the government are not always in synchrony, although tensions may not always be visible, and where visible may be ignored. This dual agenda generates tensions in the institute, with the donors' agenda often taking precedence over the local one, owing to funding considerations. This tension feeds through to individual scientists, who when making progress reports or presenting conference papers, project an agenda which may not accommodate the full extent or reality of the work they do in farmers' fields. Thus the way in which they present their own work, is filtered by the expectations and demands of the system in which they work. The experiences presented in this study, suggest that these tensions in the policies to which the institution has to align, marginalises the reality of the farmers, which largely remain outside of KARI's fences.

5. The farmer system: no gates or fences

In the farmer innovation cases analysed, much experimentation and internalisation of the results appears to takes place in the small-scale production systems. The rice , *khat* and Macadamia farmers (Chapter 5 and 6) all illustrate systems that are receptive to external ideas that can readily be adapted to specific contexts. While these farmers are involved in the same general activity, this does not necessarily close them out from other activities that they deem to be beneficial to their farming activities. This is unlike the researchers' situation, in which programme and

commodity compartmentalisation create difficulties in adjusting to relevant opportunities that may arise. This creates a kind of 'gate and fence' syndrome in the research system that the researchers seem to extrapolate into their attitude when working with farmers outside the station. This syndrome often renders the research outputs inoperable in the farmers' circumstances.

In the *khat* case, the trees supplement the farmers' cash earning, replacing the loss of coffee earnings. The small land requirement of the crop makes it suitable for cultivation in former coffee fields and small plots in the farmers' compounds. In some cases, farmers have totally replaced their coffee fields with *khat* and one can see that the coffee price deterioration has created a niche for *khat*. The unemployed youth are able to earn a living through picking of this crop and public service vehicle transporters have become critical actors in the network linking the producers with the wholesalers, retailers and the consumers. *Khat* cultivation requires minimal labour after establishment and this provides an opportunity to spread out labour in the farm. The temporal element in the enterprise is also remarkable, in that harvesting, grading and selling are all accomplished by eight o'clock in the morning and thus allows the farmers' an opportunity to deal with other issues on the farm. The segmentation in the cultivation, picking, grading, delivery, wholesale and retailing of the *khat* crop creates an enterprise that is unmatched in organisation, that adds value at every stage and rapidly responds to feedback at every level. Absence of any extension and research advice has provided a rich environment for self-experimentation and innovation. Propagation techniques, crop protection techniques are all results of farmer experimentation. The packing of the crop by specialists within the picking crews provides a market ready packaging and the compactness of the bundles is an issue with buyers who test every bundle for this attribute with retailers relaying the views of buyers to the middlemen. Feedback on the taste and quality of the *khat,* which is dependent on the treatment of the crop with, for example, fertilizers is also given to the farmer by the wholesaler and retailer, with the farmer adjusting the tree management accordingly. Formation of marketing groups and quantity regulation groups are all organisational innovations that emerge from the farmers in response to market demand signals. This has led to 'traceability' of *khat* to the source in almost a similar way to the food traceability concept in the international markets.

In the Macadamia case, the labour extensive nature of the enterprises leaves the farmers with time to engage in other activities. Harvesting of nuts, which involves collection of fallen nuts, is compatible with the farmer's busy schedule and the nut collection arrangement by the processors suits and complements these schedule. Water availability in the rice case allows cultivation throughout the year thus allowing farmers to spread out their activities between the rain-fed crop and the irrigated rice crops. Experimentation is rapid and flexible and problems that arise are addressed instantly. While a solution may not be found immediately, the environment informs the farmers over time on possible remedies that may be available. The farmers do not wait for solutions through bulletins or experts. They try out various remedies and at the same time stay open to any options that may have

been tried by their colleagues elsewhere. This renders the farmers' production systems as open systems, and without 'fences' in whatever sense. One could consider that the small-scale farmers' weaving of objectives and activities together represent an 'open gate policy' which researchers may want to utilise and copy to create innovative environments.

The school groups case (Chapter 5) illustrates that opportunities for joint and innovative experimentation do exist for KARI researchers. In this case, feedback from the members of the school clubs is mutually shared by the researchers and the members, and then incorporated into the research activity. The activities covered in the sweet potato nursery establishment complemented classroom teaching by operationalising class room concepts such as percentages, ratios, record keeping and weather charts. This was appreciated by the teachers who earlier on '*did not see how a small garden plot could become real in the classroom'*. While this activity is implemented during club meeting times and days, the teaching associated with it spilled over to other students, who were not necessarily members of the agriculture club. The researchers were able to receive suggestions, criticisms and other information raised by enthusiastic and curious members who were not shy to air their opinions, who expressed views and suggestions about the sweet potatoes at every stage. The suggestions and views of the participants and modifications made to the original designs were flexibly incorporated by the researchers. This maintained interest and provided the results (data) that were utilised in the classrooms. While this activity lasted for a short time, it generated lessons that benefited the school curriculum as well as participatory research.

The above experiences all suggest that farmers are not complacent about the technical and other innovations that they acquire. They tinker with them integrating them into their knowledge and practices. They not preclude any source; any 'actor' can be part of their network, including non-human ones. They learn as much from observing azolla, *khat a*nd experimental treatments as they learn from watching the contracted labourers, neighbours or researchers. This 'open gate' policy serves the farmers well as theirs is a rapidly changing environment. While this aligns and emerges from actor network-based thinking, this same thinking also makes clear that the farmers and researchers are often not part of the same network. Distinguishing or blending different types of knowledge is not therefore a consideration in most cases. It is only in the case of Macadamia (Chapter 6) that there is actually an interaction of the knowledge of the different actors.

As Chattaway (2005) states, generation of scientific knowledge and its utilisation is the outcome of both disciplinary and interdisciplinary interactions between written or codified and unwritten or tacit knowledge that defies codification. It also involves non-linear interaction between producers and consumers of knowledge. The knowledge needs to flow back and forth between them and this calls for building bridges between scientific disciplines. The present operations of the research system shows restricted interaction between scientific and farmers' knowledge largely due to institutional bottlenecks. However, the system could easily transform itself and

become a useful source of components for farmer innovations. Such innovations should be regarded as building blocks, which the farmer, the ultimate user, has the liberty to choose, assemble and modify, making them fit his/her context. This is because, as various authors have argued and as the farmer cases in this thesis have illustrated, science and technology and other technical innovations cannot be transferred from one context to another to wipe away the complex local conditions that give rise to poverty and environmental degradation (Keeley and Scoones 2003, Altieri and Rosset 1999, Tripp 1997). Room should be created to allow the necessary adjustments to be made. This can only occur if keen and active observations are made at every step of the long and dynamic iteration of a technical innovations with the, seemingly congested but very well orchestrated, environment of the farmer.

6. Conclusion

At this point certain issues need to be integrated and put in context in order to draw definite conclusions about participatory research in KARI. It is apparent that, throughout the different phases of the history of the Kenyan research system, the shifts intended to include the needs of smallholders in the research agenda did not fully take place. By systematically going through the different phases, one can point out certain salient characteristics that help explain this situation and this can then be used as a mirror with which to reflect the present and use the present to cast a light on the future.

Completing the shifts

The story of changes in the research system brought about by changes in the political context is a story of a sequence of incomplete shifts. Around 1954 policy sought to transform the research system so as to include the agenda of small-scale African farmers. However this change was explicitly resisted and remained unrealised, owing to prejudice lack of clear commitment by the government to change as greatly influenced by the politically powerful settler farmers. At independence, a renewed need to make a shift was seen but in practice, this did not fully materialise. This was due to the need to protect the interests of a few elite locals who took over large settler farms and together with the few remaining settler farmers who continued a commercial level of farming (chapter 2). In this context, only a few resources were made available to cater for the agenda of small-scale farmers despite the policy pronouncements in the development plans.

A third motivational wave for shifting focus and involving farmers occurred through the participatory research approaches, introduced in the 1980s and 1990s. Empirical evidence collected in this study show that this mission was not fully achieved as scientists continued to amass data that are generalizable to wide and varied environments but this needs to be adapted to the social contexts within which farmers will use it.

It is worth mentioning that the research conducted in the institute is relevant and effective in terms of addressing the needs of the national economy. However, as

stated by Hellin et al. (2006) and Misiko (2007), the agro-ecological, social and economic conditions confronting smallholder farmers make modern yield-boosting technologies unattractive unless they also possess other characteristics that they consider important. These authors emphasise that this does not mean that science has nothing to contribute to agricultural development, since farmers are eager to learn about new options and solutions to their problems. However, to be of use in contributing to poverty reduction and greater livelihood security, there is need to emphasise the application of appropriate knowledge rather than merely developing it. Adaptation of technology is a process that the farmers have perfected but research policies, professional obligations and project goals continue to be a bottleneck to recognition of such adaptations. This in turn constraints the impact of the technologies produced by researchers. There is need to interweave the research and development process with the practical application of appropriate knowledge in real life situations. This is similar to the position taken by this thesis, which argues that the research in KARI, and other similar institutes in the developing world, could be made more effective if strategies are developed to integrate the networks of researchers and farmers, thereby incorporating farmers' views into the work of researchers.

This could be achieved through the existent structures and operational procedures in place, which are currently not being sufficiently utilized in the incorporation of farmers' feedback and this needs to be strengthened. This can only happen if there is joint commitment from the institutional managers and the policy makers who control the resources for the institutes programme. The institutional incompatibilities related to the various agendas that need to be served, ought to be eliminated as well as administrative lock-ins such as timely release of funds and development of alternatives to the validation of professional quality by scientific publications. Likewise, researchers working on farm ought to change their attitude towards farmers' practices in the applied and the adaptive research process. The champions, mentioned earlier, exemplify such attitude changes. More widespread use of their 'best practice' approaches would surely change the picture in the institute and lead to a revival of active farmer involvement in the adaptation of research technologies. This is a challenge that would require researchers to take up 'participation' in a more committed and systemic way. This requires going more than merely organising a week of classroom teaching on participatory approaches, as has been done in the past. The willingness of researchers to acknowledge that they really need to learn needs to be supported by research management, policy makers and donors in providing the space for researchers to learn from farmers and among each other.

Adapting science

The learning that researchers need to do goes further than listening to farmers' feedback and taking their views seriously and to let these inform their work. It also means seeking ways of taking on board farmers' social and cultural realities. This is no mean task, especially when it implies adapting research procedures accordingly. In the course of applying technical innovations in their fields or in certain

occurrences trigger farmers to take actions or make adaptations which, to them, appear eminently rational and logical. For the researchers however, such action on the research recommendations are interpreted as interference or non adoption. If this happens in research trials, a trial site may be discarded. By viewing these adaptations as interferences, the researchers miss an opportunity to take on board farmers' opinions and expertise. While the researchers may have their own data requirements, dictated by multiple actors and demands, there should be a deliberate effort to find out what data and criteria the farmers look for in a technical innovation. This is because data collection is the stage where the nature of farmers' participation becomes clear but as seen in the empirical data (ch 4 and 5) farmers are excluded from this stage. Data is collected and analysis takes place in the research station with the appropriate statistical procedures applied to the field data to generate results that are publishable and acceptable to the scientific community.

Taking data collection as a symbol for the research culture in KARI, one could say that KARI's work principally takes place 'within the fences' of the scientific arena. Despite the fact that researchers drive out of the station and move around in farmers' fields, there is still a barrier between them and farmers in many cases. Researchers may be physically present in the farmers' fields but tacitly they are inside sealed fences beyond farmers' reach. One can consider that researchers operate in a closed system, and farmers operate in an open system.

Involvement of other actors beyond farmers and researchers

Other issues beyond the farmer-researcher relationship may also need to be addressed. The Macadamia case is a good example of how mutual and functional partnerships with relevant stakeholders in the farming environments are crucial to innovation. The principle partners are the farmers, the ministry extension staff, the stockists, processors, local authorities and market actors. Together they make up a network of actors, linked along a production–consumer chain. The KARI researchers are part of this chain, and potentially are providers of improved technology (in rice or other crops) and management of production factors. However, these actors have to be brought together. In the Macadamia case, this needed the involvement of processors following high international market prices. The research from KARI brought Macadamia production back in the picture after the trees had become an integral part of the farmer families. In more purposefully designed processes, it usually means an active approach to forging partnerships. This often involves bringing down the barriers that prevent horizontal as well as vertical communication with partners that often historically have little affinity with each other, are unused to collaborating with each other, and may in particular be unfamiliar with considering smallholder farmers as partners. The champions in KARI may have special competences in bringing together these actors, one can question whether facilitating multi-stakeholder processes fits easily with KARI's research mandate. One possibility would be to stretch the mandate of the research organisation and ensure that researchers acquire the competences needed to take up these new responsibilities. This would fit with the approach voiced under the label of IAR4D

(Integrated Agricultural Research for Development) and promoted in many African NARs (GOK 2004, KARI, 2005). Another alternative is to identify external partners who are able to direct and coordinate such processes. In participatory research the researcher-farmer relation is taken as central, but Almekinders and Hardon (2007) found in a review of a series of participatory breeding cases that a 'third' partner was a crucial player in the coordination of the process. NGOs or farmers organisations are logical partners. Extension services can also fulfil this role, as in the example of a South African initiative (Ramaru & Hagmann, 2006). In this study, a less orthodox partner emerged, the schools that facilitated sweet potato vine experimentation, allowing the KARI researchers do research and development which they are historically best equipped to do.

A first step in forging partnerships is the identification of appropriate partners, Consideration of unorthodox partners requires thorough understanding of the local context, of how people are organised and linked to each other, what their interests are and how their knowledge systems function, i.e. an understanding of the local actor-networks. It is not evident yet whether this task of identification and bringing together potential partners in technology innovation is one that fits the mandate of national research organisations (and this may well be determined by the interest of policy makers and donors). The process will undoubtedly mean that the research institutes will need to commit to a more flexible approach to research and further 'opening of their gates', which will necessarily involve the removal of obstructive policies. By 'making holes in the fences' researchers can temporarily side-step such obstructions. It is only when there is a truly enabling environment that researchers can effectively contribute to technology development and innovations that fit the needs of smallholder farmers.

7. The way forward and issues for further research

From the foregoing it is obvious that KARI needs to continue striving for more meaningful research contributions to farmers agricultural research. Partial shifts in attitude, reward system and administrative financial shifts and recognition of small farmer capacities have to become complete shifts and dualities that create tension in the operation of the institute have to be made more explicit in order to cope with them. To achieve these changes, many issues need to be dealt with. The 'how to change' question has not been fully dealt with in this study but the research has contributed some insights into KARI's functioning that could be used to make research with smallholder farmers more effective. Based on these findings also further research can be proposed that includes:

- De-construction and re-configured assemblage of research products by the farmers has to be viewed positively by the researchers. Cases in which such circumstances occur provide useful lessons to be learned from the farmer-researcher interface. Suitable methods of capturing and incorporating these processes into the research program are necessary. This capturing and

integration would re-establish the missing link between theory and practice but would also need researchers' efforts to be recognized by the system.

- KARIs structure and provision of spaces in which researcher-farmer interaction can take place should be more effectively utilised. Understanding the dualistic forces to which researchers are subject and incorporate in their working culture and attitude are essential for identifying strategies to create sufficient critical mass and expertise in the organisation to reverse the view that KARI is not having the desired impact on the small scale Kenyan farmers' agricultural production.

- Interdependence of the strategic, applied and adaptive research and involvement if other partners besides the researchers to make input in this process needs to be emphasized as it is key to the institutional change that will create responsiveness to the changing farming landscape. Exploration of strategies to enhance the establishment of these linkages is necessary.

- Strong farmer organizations form interesting partners to do research with. Strengthening existing groups may be more useful approach than creating new ones. More research should identify factors that enhance creation of communities of practice and institutionalize the technology of interest in the communities who work around jointly prioritized technological innovation. Encouraging such groups can potentially enhance KARIs effectiveness

- Owing to diverse farmer goals, practical methodologies to should be tested to replace blanket-recommendation focus and avoid bias by research projects and policies.

- Mutual and functional partnerships should be emphasised for value addition to the research process and strategies to actualize active partnerships should be explored, without overlooking unconventional partners.

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SUMMARY

Agricultural research systems in Sub Saharan Africa have been striving to ensure that research innovations emanating from their work have the desired outcomes and impact on farmers' livelihoods and other stakeholders. Low agricultural production and degradation of the natural resource base however, increasingly continues to characterize the agricultural sector and especially the food crops sub sector. This has put the research system like the one in Kenya in a precarious situation that requires a justification for its continued existence. The situation poses a challenge to the institute which has been in a constant strive to jointly generate and test appropriate technical innovations to reverse low food production and deteriorating natural resource base. The research institute with its basic, strategic, applied and adaptive agricultural research mandate started off with researchers working very closely with the settler farmers. This however changed with a shift in focus to the African farming areas in the 1950s. Introduction of participatory research approaches in the 1980s sought to re-introduce farmers' involvement in the Institute's research activities. This was however not fully realized owing to various bottlenecks and realities which would be attributed to low usage of technical innovations. These bottlenecks are examined in this thesis from a historical and current operational atmosphere perspective together with an analysis of the research process in the field with various farmer research groups as well as farmer organized groups and latent groups.

The thesis reports on the Kenyan agricultural research institute from a historical perspective tracing its origin through various developments using the notions of discontinuity and continuity (chapter 2). Using technographic methods, the research considers the heterogeneous networks in the current institute management and shop floor level operational practices and procedures (chapter 3 and 4) to understand the occurrences at various levels and hence shed some light on the nature of bottlenecks. The research goes further to investigate farmer research groups engaged in field research activities with researchers as well as farmers' own organized activities that depict farmers innovations and modifications (chapter 5) to existing innovations from a countertendency perspective. Chapter 6 explores farmer partnerships with other actors in the agriculture sector to actualize the agricultural production, processing and marketing. The chapter also reports on implementation of a consultative and mutual research process using school groups that utilize research results in practically teaching theoretical concepts in the classroom while the researchers derive researchable issues from the interaction with the school groups. This illustrates what is feasible in a mutual participatory research process.

From the above analysis of the research system in Kenya, the picture that emerges is a research organization that started off as a service provider to the

white settler farmers through strategic and applied research whose resultant technical innovations were then availed to the farmers. The farmers adapted these innovations to their environments and went out of their way to experiment with various other own introduced innovations. The results of these experiments were fed back to the researchers who used the information to guide the direction of their strategic/applied research phase. The model of technology generation and diffusion was largely linear and fairly effective owing to recognition given to the farmer experimentation for adaptation by the research system. This model was borrowed from the Western industrialized society and perhaps worked well owing to similarity in the settler farmers and the European researchers' epistemology leading to a reciprocal and harmonious relationship.

The 1953 Swynnerton plan to improve agricultural production in the African areas was a major discontinuity in the *modus operandi* of the research process in Kenya. This policy shift was however not accompanied by the necessary components to fully actualize it ending up with partial operationalization of the plan. Besides a multiplicity of possible factors that hindered full implementation, the complexity of the small scale farmers farming systems was a major one. Unlike the commercial sector, the small scale African farmer could not operate with recommendations but required a more holistic approach owing to circumstantial constraints which required consideration but the operational policies did not have room for these. Research work was confined to the research stations resulting to recommendations given to the farmers on 'good' crop and animal management practices following the good farm management approach. The recommendations gave no room for the African farmers' practices and social context as exemplified by the encouragement of model farms whose owners were called 'progressive farmers'. These model farms were expected to serve as demonstrations for the other farmers who were expected to follow suit but this did not always happen. The mis-match between the farmers' practice and the research practice was deliberately overlooked in an effort to achieve the researchers' agenda. This situation is identified as a continuity that persisted post-independence when local staff took over from colonial staff.

The country's independence marks a discontinuity in the political scene and a drive to re-orient research and extension services to the small scale Kenyan farmer. This again was not fully realized since the research operational environment remained unchanged while reliance on donors added to the emerging complex environment. The new government took over a system that had improvement of the national economy as its main focus through support to the commercial farming but had to simultaneously support the development oriented objectives of small holder farmers. The policies guiding these two goals provided the basis of the research institute's policies and as emerges from

an examination of the operational structures, there seems to be an existent gap between the two goals. An attempt made in the early 1980s to address farmer exclusion from the research process through the farming systems and participatory research approaches failed to re-introduce the mutual relations between farmers, researchers and extension service despite the facilitating structures put in place such as joint diagnostic surveys and research planning committees such as CRACs, RREACs and others. A misconnection exists between KARIs strategic and applied research (serving policy goals) on one hand and the adaptive research (serving development goals on the other). In this split, researchers have to find a way to accommodate the varying interests, besides finding ways to produce publications to ascend the professional ladder and gain acceptance in the academic circles. KARI has also to comply with donor requirements to ensure funds sustainability.

Empirical evidence on KARIs way of doing business (chapter 3 and 4) shows that to a large extent, the structures and procedures for more participation are in place but their use is less than optimal. This partly owes to the ambiguity in policy and practice which the researchers are subjected to. A few exceptional researchers have however been observed both in and outside the case study research centres who could be said to be champions of participatory research and have gone out of their research programmes/projects and policy blue prints to metaphorically speaking ''make holes'' through the research institute fences. This has come at a cost to such champions who are not regarded positively by their colleagues who view them as having an inclination towards extension. In retrospect however, such researchers have innovatively embraced what discipline focused researchers and the institute have officially tended to be silent about.

Chapters 5 and 6 present cases that fall into three broad categories which are researcher organized farmer groups, farmer organized groups, latent function groups and partnerships. The researcher organized groups illustrate how in spite of the researchers' intention to conduct participatory research as spelt out in their research proposals, they continue applying the same operational principles as applied in the on station strategic and applied research in line with their disciplinary focus and time bound project. The focus here is the ''technology package'' and in the process, existing farmers' innovations are overlooked. The farmers modify the technologies to fit them into their circumstances ending up with both actors pulling in different directions but seem to perceive themselves as following the same direction.

The farmer organized cases illustrate how farmer innovations when combined with researcher innovations provide blends of adapted techniques that are used to flexibly solve constraints of a highly dynamic farmer environment. They also illustrate how partnerships with relevant partners meet the farmers' goals with

resultant technical or social innovations as outcomes. These outcomes are achieved through experimentation and innovativeness where practical solutions to farmers' technical and social organizational problems are obtained. This has led to the conclusion that indeed the smallholder farmers are experimenters and innovators just like the settler farmers but their methods and interests are different.

The evidence collected illustrates the fact that the research conducted in the institute is relevant and effective towards making a contribution to the economy. It could however become more effective if research gates could be opened to allow farmers to not only walk into the research centres but also contribute their views and experiences to enrich the research process. Likewise, researchers walking out of the research gates ought to change their attitude towards farmers' practices and to create more room in the strategic and applied research process for farmers input. This arrangement would provide the missing link and would lead to a revitalization of farmer experimentation in the adaptation of research technologies. It is not an easy thing due to the epistemological differences between the actors and would require researchers to take up participation in a more systemic way. The only way to embrace this is by doing and reflecting and not a week's classroom teaching as has been tried in the past. Researchers have to engage systemically but also research management and policy makers and donors need to provide the space for researchers to learn form farmers and themselves. The school groups studied are examples of latent groups whose ideas and curiosity questions are presented as examples of feedback that is often ignored and that if used could result to many useful innovations. The results of the activities through data collected are shown to be utilizable in teaching many theoretical classroom concepts. An argument is therefore made for researchers to use farmer innovations as springboards or components that should blend with research station innovations to give rise to appropriate innovations. The complete 'technology packages' concept ought to give way to technical prototypes that give room for farmers to maneuver and come up with innovations that are suitable to their contexts as presented in the synthesis and way forward.

In the last chapter (ch 7) a synthesis of the various phases of the research in terms of their meanings to the practical applications of participatory research are presented. It is argued that colonial research was responsive to the colonial farmers needs due to the harmony of the farmers and the staff. With the shift in focus to the smallscale African farming, an assumption seems to have been made that the farmers' goals were in harmony with the research and government goals as was envisioned in the colonial government plans. This assumption exists to date despite the rhetoric in many documents claiming to focus attention on small scale farmers. Strategic and applied research as

practiced in KARI and other similar research organizations need to reexamine this situation with a view to allowing for the necessary flexibility and change of attitude if appropriate innovations in line with field realities are to be developed. It is also argued that the scope of participatory research should be extended beyond technical innovation to embrace innovations in form of existent social formations and partnerships in line with a changed farmer clientele and other socio-political and similar realities. Present policies do not cater for this flexibility as ideally, research was originally mandated to generate technical knowledge only leaving the rest of the work to other actors. With participatory approaches, the separation is not expected but a disconnect still exists between theory and practice. As a way forward, this thesis argues that for research organizations to remain relevant today, the gates separating the research stations from the outside world have to be opened in addition to holes through the fences for information exchange to occur. This requires a deliberate effort to be made to ensure that the information flowing into the research institution plays a role in the collaborative activities between researchers and farmers and particularly in research agenda formulation.

This thesis therefore proposes that policies have to be put in place that allow views, opinions and goals of other stakeholders to be accommodated in the research agenda to avoid the 'cut and paste approach' or blue print approach in research. This should give way to one based on innovations within the projects. The rigidity and research domination that has characterized research operations to date has to give way to an innovations oriented institutional culture. This calls for a change in mindsets and attitude of the research managers and individual scientists' to be responsive to the farmers and other stakeholders input. The farmers' and other stakeholders' attitude and practices also have to change from being receivers of services from research and other providers to being equal partners in a venture where former providers are facilitators. This will encourage sharing of their ideas and opinions.

As a step towards this, a change is called for in the scientist evaluation criteria as well as change in attitude in the research institute to reflect this paradigm shift. A re-tooling of research scientists and research managers on relevant social aspects that affect the technical innovations also need to be conducted. The widening of the research horizons from a focus on technical innovations only to others such as synergistic partnerships with relevant actors that support agriculture will be needed. This will require flexibility on the part of the research organization and research on factors that will need to be in place to facilitate and enhance functional partnerships. Institutional arrangements that support farmer efforts may not be feasible through external funds owing to divergence in agenda between the external actors and the local contexts. This

scenario then calls for the government to explore internal sources of funds to be channeled to research as the institute transforms itself into a learning organization flexible enough to accommodate the dynamic change processes.

SAMENVATTING

Landbouwkundig onderzoek in het Afrika bezuiden de Sahara heeft er altijd naar gestreefd om ervoor te zorgen dat de onderzoekinnovaties die uit hun koker kwamen de gewenste resultaten hebben en het leven van boeren te verbeteren. Lage landbouwproductie en de degradatie van de natuurlijke hulpbronnen karakteriseren nochtans de landbouwsector en vooral die van de voedsellandbouw. Dit heeft het onderzoeksysteem zoals in Kenia in een precaire situatie gebracht en een rechtvaardiging voor zijn voortbestaan vereist. Dit vormt een uitdaging voor het instituut dat er constant naar streeft om technische innovaties te produceren en te testen om het tij van lage voedselproductie en verslechterende natuurlijke rijkdom te keren. Het onderzoekinstituut met zijn fundamenteel, strategisch, toegepast en adaptief onderzoeksmandaat is ontsproten aan een situatie waarin onderzoekers zeer nauw met de blanke kolonisten samenwerkten. Dit veranderde in de jaren '50 toen de aandacht verschoof naar de Afrikaanse landbouwgebieden. De nadruk op participatieve vormen van onderzoek gedurende de jaren '80 had tot doel om boeren opnieuw te betrekken bij de onderzoekactiviteiten van het instituut. Dit werd nochtans niet volledig gerealiseerd vanwege diverse knelpunten en werkelijkheden die in een beperkt gebruik van technische innovaties resulteerden. Deze knelpunten worden in dit proefschrift onderzocht vanuit een historisch en hedendaags perspectief samen met een analyse van het onderzoekproces met boerengroepen evenals door boeren zelf opgezette groepen en ook zogenaamde latente groepen.

In hoofdstuk 2 wordt vooral stil gestaan bij de oorsprong en geschiedenis van het Keniaanse landbouwonderzoekinstituut daarbij gebruik makend van het begrippenpaar continuïteit en discontinuïteit. Ik maak gebruik van de technografische methode om de heterogene netwerken in de huidige operationele praktijk en procedures van landbouwkundigonderzoek te onderzoeken (hoofdstuk 3 en 4). Met name hierdoor ontstaat een goed begrip van de aard en intensiteit van knelpunten op diverse niveaus. Door de boerengroepen te onderzoeken die samenwerken met onderzoekers alsmede de door boeren zelf georganiseerde activiteiten ontstaat een helder beeld van boereninnovaties en aanpassingen (hoofdstuk 5) aan bestaande innovaties. Hoofdstuk 6 onderzoekt samenwerkingsverbanden met andere actoren in de landbouwsector voor de productie, verwerking en marketing. Het hoofdstuk documenteert de implementatie van een onderzoekproces met daarin aandacht voor consultatie en gezamenlijk onderzoek met scholen. Dit proces illustreert wat in participatief onderzoek realiseerbaar is.

Het beeld dat zich aftekent van het onderzoeksysteem in Kenia, is er een van een onderzoekorganisatie wies oorsprong ligt in een positie van dienstverlener aan blanke kolonisten; e dit middels strategisch en toegepast onderzoek

waarvan resulterende technische innovaties ter beschikking van de boeren kwamen.. De boeren pasten deze innovaties aan de eigen omstandigheden en combineerden dit met verschillende ander eigen innovaties en experimenten. De resultaten van deze experimenten werden teruggekoppeld naar de onderzoekers die de informatie gebruikten om richting te geven aan hun strategisch/toegepaste onderzoek. Het model van technologieontwikkeling en verspreiding was lineair en redelijk efficiënt ten gevolge van de waarde die werd toegekend aan aanpassing door het onderzoeksysteem zelve. Dit model vindt zijn oorsprong in de Westerse, geïndustrialiseerde maatschappij en werkte misschien goed ten gevolge van de overeenkomsten in epistemologie tussen kolonisten en de Europese onderzoekers.

Het Swynnerton plan van 1953 om landbouwproductie in de Afrikaanse gebieden te verbeteren vertegenwoordigd een belangrijke discontinuïteit in de *modus operandi* van het onderzoekproces in Kenia. Deze beleidsverschuiving ging nochtans niet vergezeld van de noodzakelijke verandering en dus eindigde het plan in slechts een gedeeltelijke uitvoering ervan. Naast een veelvoud van mogelijke factoren die volledige implementatie belemmerden, vormde de ingewikkeldheid van de kleinschalige landbouwsystemen een zeer belangrijke. In tegenstelling tot de commerciële sector, kon de kleine Afrikaanse boer niet met de aanbevelingen werken, maar vereiste een meer holistische benadering vanwege tal van beperkingen. Het operationele beleid van toen had echter geen ruimte voor een dergelijke benadering. Het onderzoekswerk werd beperkt tot de onderzoekstations die aanbevelingen gaven aan boeren inzake 'goed' boeren. Deze aanbevelingen gaven geen ruimte aan boeren om de innovaties aan te passen aan hun eigen omstandigheden en wensen. Modelboeren en dito bedrijven werden goede voorbeelden gesteld voor andere boeren die werden geacht dit voorbeeld te volgen, hoewel dit niet altijd gebeurde. De wanverhouding tussen de boerenpraktijk en de onderzoekpraktijk werd doelbewust genegeerd vanwege de eigen agenda van de onderzoekers. Deze situatie wordt aangemerkt als een continuïteit die voortduurde ook na de onafhankelijkheid.

De onafhankelijkheid kan worden aangemerkt als een discontinuïteit in de politieke sfeer en een drijfveer om onderzoek en voorlichting op de kleinschalige Keniaanse landbouw te heroriënteren. Dit werd opnieuw niet volledig gerealiseerd aangezien de onderzoeksomgeving onveranderd bleef terwijl de afhankelijkheid van donors er een nieuwe complexiteit aan toevoegde. De nieuwe overheid nam een systeem over dat verbetering van de nationale economie als hoofddoel had gesteld door steun aan de commerciële landbouw te verlenen, maar die tegelijkertijd ook tot doel had de kleine boerenlandbouw te ondersteunen. Dit tweesporenbeleid vormde de basis van het beleid van het onderzoekinstituut en zoals uit de analyse zal blijken van de operationele structuren bestaat er nog steeds een zeker hiaat tussen de twee

doelstellingen. Een poging in de begin jaren '80 om aandacht te schenken aan de uitsluiting van boeren door invoering van *farming system* en participatief onderzoek slaagde er niet in om de wederzijdse relaties tussen boeren, onderzoekers en de voorlichtingsdienst te veranderen en te verbeteren; dit ondanks dat er faciliterende structuren in het leven waren geroepen zoals planningscommissies als CRACs en RREACs. Er bestaat nog steeds een spanningsveld tussen enerzijds strategisch en toegepast onderzoek van KARI (de dienende beleidsdoelstellingen) en anderzijds het adaptief onderzoek (dienende ontwikkelingsdoelstellingen). In dit spanningsveld moeten de onderzoekers een manier vinden om de verschillende belangen te dienen, naast het zoeken nar mogelijkheden om te publiceren ten einde op de professionele ladder te stijgen en erkenning in academische kringen te krijgen. KARI heeft daarnaast ook aan donorvereisten te voldoen om de continuïteit van met name de financiering te borgen.

De analyse van de wijze waarop KARI opereert (hoofdstuk 3 en 4) toont aan dat voor een groot deel de structuren en de procedures voor meer participatie op zijn plaats zijn maar hun gebruik is minder dan optimaal. Dit is gedeeltelijk te wijten aan de ambiguïteit in beleid en praktijk waaraan onderzoekers worden onderworpen. Er zijn echter uitzonderlijke onderzoekers zowel binnen en buiten de onderzoekscentra waarvan gezegd kan worden dat ze kampioenen zijn van participatief onderzoek en die zich ontworsteld hebben aan de beleidsblauwdrukken voor onderzoek. Metaforisch gesproken ebben zij 'gaten in de omheining' van het onderzoeksinstituut geknipt. Dit is hun duur komen te staan aangezien veel collega's hen negeren en de neus ophalen voor hun werk. In retrospectief, dergelijke onderzoekers hebben innovatief onderzoek omhelst waar de disciplinair geconcentreerde onderzoekers en het instituut niet of nauwelijks naar verwijzen.

Hoofdstukken 5 en 6 presenteert data over het wel en wee van de drie categorieën van onderzoek: boerengroepen die door onderzoekers zijn georganiseerd, groepen door boeren zelf opgezet, en de groep van latent functionerende groepen en vennootschappen. De eerste categorie groepen illustreert hoe ondanks dat het de bedoeling is om participatief onderzoek te doen, de onderzoekers de zelfde operationele principes blijven toepassen zoals die in het post strategische en toegepaste onderzoek, overeenkomstig hun disciplinaire invalshoek en tijdskader. De nadruk is hier het 'technologiepakket' en in het proces worden de innovaties van boeren genegeerd. De boeren op hun beurt wijzigen de technologieën in en tijdens gebruik.
De tweede categorie boerengroepen illustreert hoe de boereninnovaties gecombineerd met innovaties uit het onderzoeksysteem een mengelmoes van

aangepaste technieken biedt die worden toegepast inde dynamische context van de kleine boerenlandbouw. Het illustreert ook hoe de samenwerking met relevante partners de doelstellingen van boeren dient: namelijk het zoeken naar technische of sociale innovaties. Deze resultaten worden verkregen door proefneming en innovativiteit te verbinden met technische en sociale, organisatorische problemen van de boeren. Dit leid tot de conclusie dat inderdaad de kleine boeren experimenteerders bij uitstek zijn en vernieuwers evenals de kolonistenwaren, maar hun methodes en belangen zijn verschillend.

De gegevens die zijn verzameld illustreren dat het onderzoek dat in het instituut wordt gedaan een bijdrage levert aan de economie en derhalve relevant en efficiënt is. Het kan echter nog efficiënter worden als de poorten van het onderzoeksinstituut zouden kunnen worden geopend om boeren toe te staan niet alleen in de onderzoekscentra rond te lopen maar ook hun meningen en ervaringen kunnen delen teneinde het onderzoekproces te verrijken. Eveneens, Onderzoekers op hun beurt zouden de poort uit moeten en het veld in om op deze manier meer ruimte te scheppen voor strategisch en toegepaste onderzoekproces op basis van een input van boeren. Dit zou de ontbrekende schakel kunnen zijn en zou kunnen leiden tot een revitalisering van boeren experimenten in de aanpassing van innovaties uit onderzoek. Dit is niet eenvoudig gezien de epistemologische verschillen tussen de betrokken actoren; immers het betekend dat zijn participatie meer dan nu het geval gestalte moeten geven aan participatie. De enige manier om dit te omhelzen is door het doen; het nadenken in seminars zoals in het verleden is geprobeerd over hoe het te doen is onvoldoende. De onderzoekers moeten systematisch en regelmatig participatief onderzoek gaan doen. Maar om dit te realiseren moeten ook de managers en donoren de ruimte voor onderzoekers scheppen om dit te kunnen doen. De schoolgroepen zijn voorbeelden van latente groepen die ideeën en vragen over hoe iets werk worden gerealiseerd; dit zijn voorbeelden van een terugkoppelen dat vaak wordt genegeerd. Indien daar gebruik van wordt gemaakts dan kunnen daar vele nuttige innovaties uit voortvloeien. Op zijn beurt kan dit ook weer worden teruggekoppeld theoretische concepten voor gebruik in het onderwijs. Onderzoekers zouden boeren innovaties als springplanken voor systeeminnovaties moeten zien en gaan gebruiken.. Het aloude concept van de `technologiepakketten' moet mijns inziens meer ruimte bieden aan innovaties door boeren.

Het laatste hoofdstuk (7) is een synthese van de diverse fasen van het onderzoek in termen van hun betekenissen voor praktische toepassingen van participatief onderzoek. De stelling hier is dat het succes van het koloniale onderzoek voor de kolonisten toe is te schrijven aan de harmonie tussen kolonisten en onderzoekers. Met de verschuiving in nadruk naar de

kleinschalige Afrikaanse landbouw, schijnt een veronderstelling gemaakt te zijn dat de doelstellingen van de kleine boeren ook in overeenstemming waren met die van onderzoek en overheid. Deze veronderstelling heerst tot op heden nog steeds ondanks de retoriek in de vele beleidsdocumenten voor meer aandacht op kleinschalige landbouw. Het strategische en toegepaste onderzoek zoals die in KARI en andere gelijkaardige onderzoekorganisaties wordt uitgevoerd moet deze situatie op nieuw gaan bekijken met oog voor meer flexibiliteit en verandering van houding. Maar de scope van participatief onderzoek moet ook voorbij gaan aan technische innovaties per se en zou moeten worden hervormd ten einde ruimte te scheppen voor nieuwe sociale verbanden die innovaties genereren die beantwoorden aan een telkens veranderde landbouw. Het huidige beleid biedt deze flexibiliteit niet daar idealiter het onderzoek slechts als mandaat had nieuwe technische kennis te genereren. De andere betrokken actoren behoefden deze slechts toe te passen. In de participatieve benadering van onderzoek wordt deze scheiding niet gemaakt maar toch bestaat er nog steeds een kloof tussen theorie en praktijk. Als oplossing poneert dit proefschrift dat willen onderzoekorganisaties vandaag de dag relevant blijven, de poorten moeten worden geopend en daarnaast dat er gaten in de omheiningen worden geknipt om de informatievoorziening te vergemakkelijken. Dit vereist dat er een weloverwogen inspanning wordt geleverd om ervoor te zorgen dat de informatie die de onderzoekinstelling binnen stroomt een rol van belang speelt in de samenwerking tussen onderzoekers en boeren, in het bijzonder daar waar het gaat om de formulering van de onderzoekagenda.

Middels dit proefschrift stel ik daarom voor dat het huidige beleid dat meningen, adviezen en doelstellingen van andere belanghebbenden in de onderzoekagenda toelaat moet worden aangepast om de `plak en knip benadering of blauwdrukbenadering in onderzoek te vermijden. Dit zou aan moeten uiting geven aan een systeem dat is gebaseerd op innovaties binnen de projecten. De starheid die onderzoek tot op heden heeft gekenmerkt, moet ruimte beiden en maken voor innovatie oriënteerde institutionele cultuur. Dit roept om veranderingen van denkrichtingen en houdingen van de onderzoekmanagers maar ook van de individuele wetenschappers ten einde adequaat te kunnen op de inbreng van boeren en andere belanghebbenden.. De houding van de laatsten moeten ook veranderen, en wel van een rol als ontvangers van de diensten van onderzoek en andere leveranciers naar een rol als gelijken. Dit zal het delen van hun ideeën en adviezen bevorderen.
Om dit te bereiken moeten ondermeer de criteria van evaluatie van individuele wetenschappers veranderen. Dit houdt ook een heroriëntatie in van onderzoekers en de managers op relevante sociale aspecten die technische

innovaties beïnvloeden. Een verbreding van de onderzoekhorizon, van een met een nadruk op technische innovaties naar een meer synergetische zal hard nodig zijn. Dit zal flexibiliteit vereisen van de kant van de onderzoekorganisatie. De institutionele regelingen die activiteiten van boeren ondersteunen kunnen wellicht niet uit externe fondsen worden gefinancierd; dit vanwege een divergentie in agenda's van de 'externe' actoren en de lokale contexten. Dit scenario vereist van de overheid dat eigen bronnen van financiering te zoeken en die het onderzoek zo kanaliseren er een instituut uitvoorkomt dat zelf lerend is en flexibele genoeg is om zich aan te passen aan dynamische veranderingsprocessen.

Curriculum Vitae

Geoffrey Mbuthia Kamau was born on 10th September 1957 in Muranga District of Central Province Kenya to Samuel Kamau and Millicent Muthoni. He attended Kabui primary school, Gaichanjiru Secondary School and Njirii's High School for primary, secondary and A-levels. He joined the University of Nairobi for a Bachelor of Science degree in Botany, Zoology and Geography which he successfully completed in 1978. In 1981, he was employed by the scientific research division (SRD) of the Ministry of agriculture as an Assistant Agricultural Officer and posted to the Coast Agricultural Research station at Mtwapa in Mombasa as an agronomist in the maize section. In 1988, he joined Texas A&M College Station, USA for a Masters of Science degree in Agronomy which he completed in 1990. His thesis was entitled 'Use of Sulphonyl urea herbicides for control of Johnson grass in Corn'.

After his MSc, he rejoined his station by then a regional research centre where he continued doing research on maize and was also appointed deputy Centre director. In year 2000, he was transferred to the KARI headquarters and appointed the National coordinator of the Institute's new technology up-scaling programme called Agricultural Technology and Information Response Initiative (ATIRI). He coordinated the programme until 2002, when he was awarded a PhD fellowship from the 'Participatory Approaches and Up-scaling' (PAU) programme financed by the Rockefeller Foundation and coordinated by the Technology and Agrarian Development Group, Department of Social Sciences, Wageningen University. His PhD study ''Researching with farmers; a study of KARIs participatory research in context' was done under the supervision of the Technology and Agrarian Development (TAD) group.

Completed Training and Supervision Plan
Geoffrey Mbuthia Kamau

Description	Department/Institute	Month/year	Credits
I. Orientation			
Proposal development and literature review	Wageningen University	Feb to Oct 2002	4
CERES Introductory Courses	CERES Utrecht University	March to May 2002	4
II. Scientific and Professional skills			
Learning workshop of the PAU programme on building personal mastery and organizational capacities.	PAU program, Boxmeer, The Netherlands	October 9-18 2002	2
English Scientific writing course	CENTA, Wageningen University, The Netherlands	Feb to March 2002	1
A practical course on the methodology of field work	Nijmegen University, The Netherlands	3 -7 June 2002	1
Sharing experiences on PhD research on participatory approaches and up-scaling	PAU program, Malindi, Kenya	13-18 June 2004	1
Learning in PAU: Support to Analysis and PhD thesis write up	Organized by PAU program, Jinja Uganda	24-28 January 2006	1
III. Conference presentations			
''Innovation and information system in '*jua kali*' rice cultivation in Central Kenya: Self mobilization and the battle in the swamps"	VAD conference, Frankfurt, Germany	23-28 July 2006	4
"Innovation and information exchange practices in farmer groups and implications for technology development- From rigidity to flexibility?''	CERES Summerschool, Wageningen, The Netherlands	26-28 June 2006	4
"From strangler to nourisher: How novice rice farmers turned challenges into opportunities''	Innovations Africa Symposium, CIAT, Munyonyo Speke Resort, Uganda	21–23 Nov 2006	4
Total			**26**