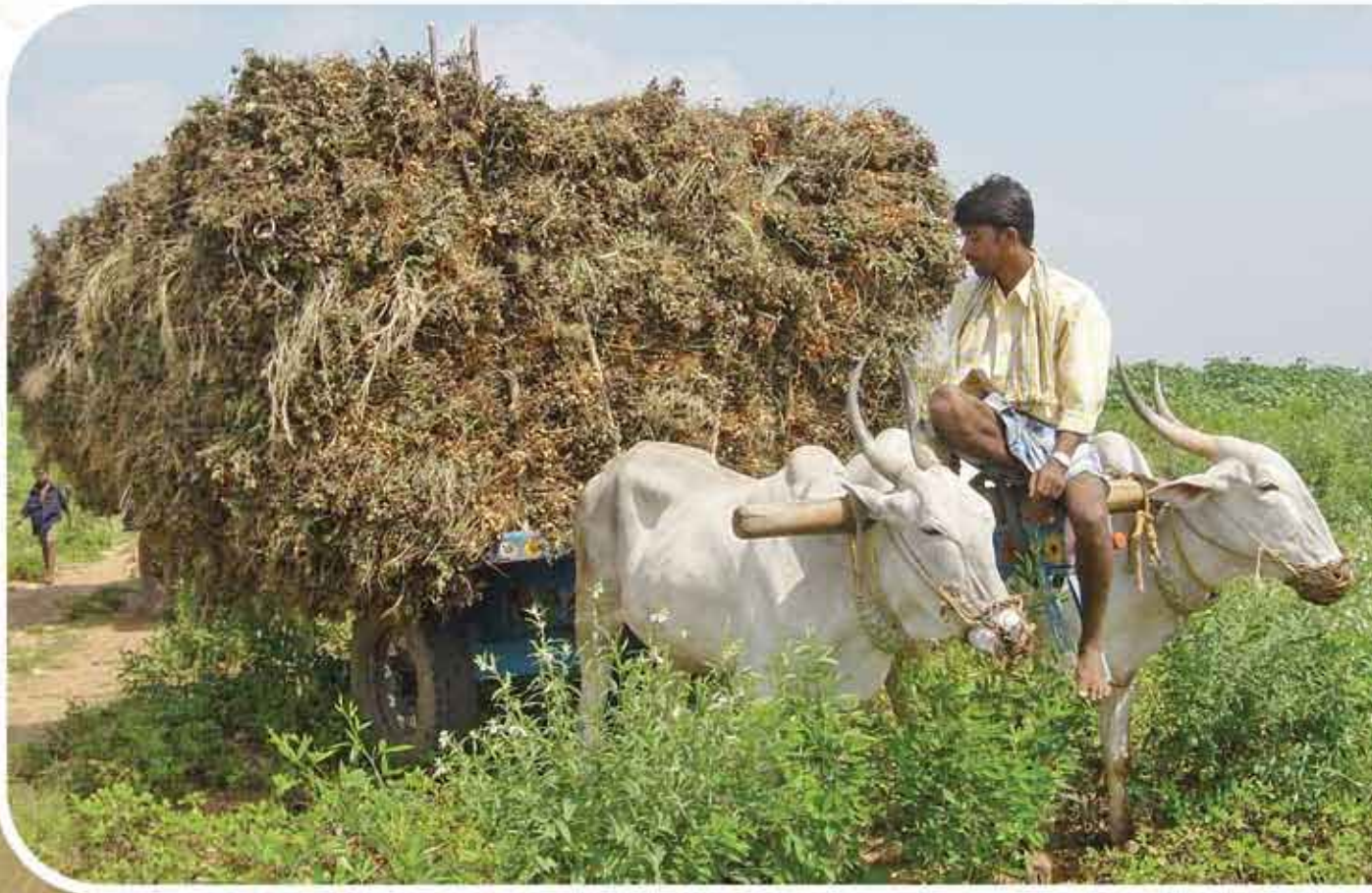
Reframing Technical Change: Livestock Fodder Scarcity Revisited as Innovation Capacity Scarcity



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Abstract

This document, divided into three sections, develops a conceptual framework for a project on livestock fodder innovation – the Fodder Innovation Project (FIP). Livestock is important to the livelihoods of poor people in many regions of the developing world. A generic problem found across this diverse range of production and marketing contexts is the shortage of fodder. This paper argues that to address this problem it is necessary to frame the question of fodder shortage not from the perspective of information and technological scarcity, but from the perspective of capacity scarcity in relation to fodder innovation. To support this position the first section presents case studies of experience, from an earlier fodder innovation project, that suggest that while fodder technology is important, it is not enough. There is a large institutional dimension to bringing about innovation, particularly with respect to the effectiveness of networks and alliances needed to put technology into use. The second section begins by reviewing the evolving paradigms of agricultural research and innovation over the last 30 years or so and explains the emergence and relevance of the innovation systems concept to agricultural development. It then presents a framework for exploring fodder innovation capacity, with particular emphasis on the patterns of interaction needed for innovation and the policy and institutional settings needed to enable these processes. The third section reviews the wide range of existing tools available to investigate institutional change. It then recommends that an eclectic approach of mixing and matching tools to the emerging circumstances of the research is the best way forward.

Key words: Livestock; agriculture; innovation; poverty reduction; technology; partnerships; India; Nigeria; livestock innovation systems; innovation capacity; institutional change; fodder; welfare outcomes; counterfactual; parallel universe; plausible causal connections; M&E; benchmarking; evaluation; learning

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A Conceptual Framework

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The International Livestock Research Institute (ILRI) and the United Nations University (UNU-MERIT) in collaboration with the International Crops Research Institute in the Semi-Arid Tropics (ICRISAT) and the International Institute for Tropical Agriculture (IITA) on behalf of the System-wide Livestock Programme (SLP) of the Consultative Group on International Agricultural Research (CGIAR)

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Introduction

Technical change has played a major role in the rural development strategies of most developing countries over the last half century. This is a strategy that is as notable for its failures as its successes in countries that usually rely on either technology imports from the developed world or research-driven technology transfer. This document, divided into three sections, develops a conceptual framework to revisit this conundrum. The framework developed draws inspiration from contemporary ideas about innovation. The empirical focus of the paper is the case of livestock fodder scarcity — a particularly intransigent problem that UNU-MERIT, ILRI and their partners are trying to apply the innovation perspective to.

Livestock is important to the livelihoods of poor people in many regions of the developing world. A generic problem found across this diverse range of production and marketing contexts is the shortage of fodder[1]. The reasons range from increasing competition for resources to environmental degradation in common property areas and the need to increase animal intake in intensive production systems. This is not a new problem and the agricultural research community has made considerable efforts over the last 40 years or so to develop new fodder technologies and to introduce new fodder varieties and feeding systems.

While there have been successes, this research — and associated efforts to disseminate fodder-related technologies — has made limited progress in resolving the fodder scarcity problem. This is particularly disappointing because maintaining or improving livestock production and marketing could have important social and economic consequences for poor people with livestock-based livelihoods. In addition, upgrading throughout the livestock value chain is needed to survive, cope and compete in dynamic production and market conditions at sub-national, national and global scales.

[1] The term fodder is used in the sense of plants grown specifically for feeding animals. These include grass, legume and tree species as well as crop residues.

The International Livestock Research Institute (ILRI), United Nations University in Maestrict (UNU-MERIT), The International Crops Research Institute for the Semi Arid Tropics (ICRISAT) and the International Institute of Tropical Agriculture (IITA) are collaborating on a research project to explore fodder scarcity from a new perspective. This new perspective involves exploring ways to strengthen the capacity to innovate. To make the same point differently, the research will frame the question of fodder shortage not from the perspective of information and technological scarcity, but from the perspective of capacity scarcity in relation to fodder innovation.

In recent years, attempts to deal with the shortcomings of a technology-led approach to innovation have led to the emergence of a number of principles on how to move forward: the need to recognise the complexity of farming as part of a wider system of social and economic activity; the need to create patterns of interaction between different sources of agricultural knowledge; the need to change the working practices of pivotal organisations, particularly agricultural research organisations, but also others in the development sector; and the need to create an enabling policy environment for technical change. These ideas have led to an increasing focus in rural development policy on innovation rather than research (see World Bank 2006).

Much of the contemporary policy debate on technology and economic performance is founded on similar concepts. Critical to this viewpoint is the recognition of innovation as a systemic, embedded phenomenon where the capacity to respond to change by a process of continuous innovation assumes importance over specific technologies and is the result of the particular patterns of interaction of many players in a specific context. In other words, rather than just giving emphasis to the creation of knowledge and technology through research, the new perspective emphasises the whole range of processes, factors and actors that shape how knowledge is created, adapted, diffused, shared, and most importantly, put into use. This emphasis on using knowledge in economically and socially significant ways — as the definition of innovation would suggest — resonates very strongly with growing levels of accountability in public interventions like agricultural research, where impacts articulated in welfare terms are taking precedent over outputs articulated in technological terms.

One of the ways these ideas are being brought to bear on development policy debates is through the concept of an innovation system. It is this idea that takes centrestage in the research project, undertaken by ILRI, UNU-MERIT and its partners, which this paper discusses. The geographic focus of this work is India and Nigeria.

This paper provides a conceptual framework, methods and guidelines for conducting this research. The first section reviews the historical experience of developing and promoting fodder technology and, in particular, the lessons learnt from the approaches experimented with in an earlier phase of this current project (for convenience this earlier work is referred to as Phase I). The second section reviews the conceptual and empirical literature dealing with recent thinking on agricultural innovation and builds on this to develop a conceptual framework for exploring fodder scarcity from a systems-of-innovation perspective. The third section reviews methods and tools for conducting this sort of research.

SECTION I. A REVIEW OF HISTORICAL AND RECENT EXPERIENCES

1. Historical Perspectives on Addressing Fodder-Feed Scarcity through Research, Technology Development and Promotion

Fodder scarcity and the poor

An adequate supply of livestock fodder is crucial to the livelihoods of millions of people across the developing world. Livestock producers meet their fodder requirements through a combination of crop residues and grazing on common lands, private lands, forests, fallow agricultural lands and harvested agricultural lands. Fodder requirements are also met through cultivated forage crops (cultivated mostly by large landholders). Others purchase this fodder. Availability and access to quality fodder resources, however, is emerging as an important constraint in livestock production. Increasing fodder and water shortages are recurring phenomena, not only in arid and rain-fed regions, but also in irrigated areas and regions receiving higher rainfall. A policy push toward more productive but input-intensive breeds has also increased the demand for more fodder. At the same time, the shrinking of common property resources (industrial use, plantations, etc.) and the deterioration in their quality has reduced the availability of grazing lands.

The estimated doubling of demand for meat and milk in developing countries in the next two decades offers significant opportunities to poor livestock producers to increase their income from livestock farming. Livestock is important not only to farmers who own farmland and practise mixed crop-livestock agriculture, but also to a large number of landless people who depend mainly on common property resources for fodder and to pastoralists who migrate with their livestock. There are 20 to 25 million pastoralists in Sub-Saharan Africa and similar numbers in South Asia. The chief difference between the two regions is that in Sub-Saharan Africa pastoralists tend to be cattle-keepers, whereas in South Asia they mainly keep small ruminants — sheep and goats.

Livestock is also increasingly becoming a fully commercial (industrial) enterprise in regions that are well-connected with milk markets in cities and big towns. It is estimated that in India alone almost 18 million people derive their livelihood from livestock.

Fodder technology development and transfer: Fodder scarcity as technology scarcity

The major approach for addressing feed and fodder scarcity traditionally revolved around evaluating various forage crops (grasses, shrubs, trees) for their yield, nutritional content and impact on livestock production parameters (e.g. milk yield, liveweight gain), and then disseminating this knowledge as fodder technology (usually embodied as seed of improved varieties and their management and use) through animal husbandry departments and dairy development agencies. To support production and availability of these improved seeds, the national/state governments often established fodder seed production farms. Apart from making these seeds available to public sector agencies for wider distribution, these farms also served as demonstration and training units for fodder promotion. Lack of availability of quality fodder seeds was initially considered to be the main reason for limited availability of fodder and so the approach was to develop improved varieties of fodder crops through research; multiply them in fodder seed farms; distribute the same along with information on their benefits and use (extension). The key assumption was that lack of technology was the key constraint and that research could address this problem.

At the global level ILRI, The International Centre for Tropical Agriculture (CIAT in its Spanish acronym), and the International Centre for Arid and Dryland Agriculture (ICARDA) — international research centres of the Consultative Group for International Agricultural Research (CGIAR) — have taken a lead role in fodder research (evaluation of different crops and varieties and developing better systems of production and management). Other CGIAR centres — ICRISAT, IITA and the International Centre for the Improvement of Maize and Wheat (CIMMYT in its Spanish acronym) — have, often in partnership with ILRI, CIAT and ICARDA, concentrated on developing dual-purpose varieties for grain and fodder (e.g. sorghum, cowpea, maize). National programmes were established in many developing countries during the 1960s and 1970s to test improved genotypes in forages to generate forage production technologies relevant to the socio-economic conditions in different agro-climatic regions. Technologies on managing pasture lands have also been developed through this network of international and national agricultural research organisations.

With little evidence of adoption in farmers' fields, fodder researchers in the 1990s began experimenting with participatory research approaches, i.e., engaging farmers directly in technology development and testing. This was expected to better match varietal characteristics with the real needs and interests of livestock producers. The process ranged from getting feedback on fodder varieties from livestock producers before releasing the varieties, to the provision of a range of forage species (grass, legumes, trees) for farmers to experiment with ('baskets of options'), to creating forage systems best suited to

their farming conditions. "The underlying principle was to give farmers ingredients and information and not recipes (Hill and Roothaert, 2002)".

Researchers have evaluated forages for adaptation and yield at many sites throughout the tropics over the last 20 years, including through regional networks convened by CIAT and ILRI with their national partners in Latin America and Sub-Saharan Africa (Toledo and Schultze-Kraft, 1982; Dzowela, 1988). However, although a range of species has been evaluated and superior accessions for a range of environments and farming systems or niches identified, the germplasm available in the genebanks of CIAT and ILRI has not yet been widely adopted by smallholders (ILRI, 2006a; b). Experience from the Indian Grasslands and Fodder Research Institute (IGFRI) is no different. "Even after investing enormous amounts of scientific manpower and economic resources for more than 25 years, IGFRI's efforts generally fail to serve the majority of the farmers, especially small-holder farmers in rain-fed areas." (Biradar and Ramesh, 2002).

New players and experiments in fodder supply

Although fodder research and development is still publicly funded and directed in most developing countries, recent years have witnessed a number of private companies getting involved in fodder seed multiplication and distribution. In India, for example, the organised private sector dairy industry has taken an interest in fodder promotion. There have also been several experiments in fodder delivery promoted by co-operatives and NGOs. For example, Krishna (Dairy Co-operative) Milk Union in Andhra Pradesh experimented with "satellite fodder farms" to decentralise fodder availability. Some villages in Andhra Pradesh in southern India have emerged as fodder seed (multiplication) villages where farmers grow fodder crops to produce seed for sale.

Following the renewed interest in indigenous knowledge in recent years, several NGOs have initiated efforts to document the traditional knowledge on livestock production, feeding and fodder systems. Organisations like the Andhra Pradesh Grazing and Fodder Forum (ANTHRA) in India have documented the species traditionally used as fodder and have also validated their nutritional qualities. Moreover, many of these NGOs also have a strong focus on poor people in livestock development and have attempted to understand the fodder scarcity issue. Some NGOs, such as the Bharatiya Agro Industries Foundation (BAIF) in India, have been experimenting with different systems of fodder management under sylvo-pastoral systems. Others, such as the above-mentioned ANTHRA, have started to advocate policy change in relation to fodder. Policies related to land use, grazing, forest management and wasteland development influence the availability and use of fodder and, in particular, affect landless, nomadic livestock keepers who rely on these areas.

It is now apparent that the availability of and access to fodder is no longer a mere technological issue, although new knowledge on fodder continues to be important. The next segment looks at the experience of an earlier phase of ILRI's fodder promotion work in order to draw out some more specific principles for reframing the fodder scarcity question.

2. Project Phase I (2003-2006). Transition to a New Approach for Dealing with Fodder Scarcity

Project origins and approach

The Phase I project, as originally conceived, framed the problem of fodder scarcity as one of technical and information scarcity on fodder production. Its central approach involved identifying and disseminating new varieties of fodder or dual-purpose crops aimed at increasing fodder supply. This involved participatory selection[6] of fodder options with an emphasis on genetically-improved germplasm and new planting designs. The project used the language of "scaling-out" to describe the way technologies would diffuse beyond the project scale; and "scaling-up" to describe the way an enabling environment for technical change would be created at the level of national policy. Scaling-out was envisaged as taking place through farmer-to-farmer exchange and the dissemination activities of development organisations partnering with the project. Scaling-up in the policy process was largely not addressed by the project.

During Phase I it became clear to the project team[7] that the approaches of the project — that were broadly of a technology transfer type — were not adequate to facilitate changes likely to lead to a reduction in fodder scarcity. As the project progressed it became apparent that, in fact, technical change was going to need the co-operation of many players related to the livestock sector and that this, rather than the technical robustness of particular fodder varieties, would determine success.

In the meantime the project had inherited a number of different fodder-related activities — usually building on ongoing programmes of partner organisations[8]. The role of the project was to support these ongoing activities — mainly by the provision of improved planting material. These different initiatives (some of which are discussed in detail later in this section), in many senses, developed a momentum of their own. They were managed by partner organisations — both public research organisations and NGOs — and while fodder was a common interest, they all pursued strategies that reflected imperatives and mandates of their organisations and the particular context in which they were working. So, for example, while the research organisations gave priority to promoting varieties they had developed, the NGOs tended to have a more broadbased interest in helping their constituencies of rural communities.

Meanwhile, the project team realised that it would be useful to document these different experiences and use lessons from them as a foundation for developing a more effective way to deal with the fodder scarcity problem. Recognising that the scope of partnership was likely to be a critical concern in any approach developed, the project had the foresight to commission studies of the patterns of interaction of its project activities in particular rural domains. These

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6 i.e. with the participation of farmers

7 This consisted of ILRI social and mainly livestock scientists

8 The project team and its documentation used the term partner to describe its relationship with those it worked with. In reality these relationships varied: some resembled partnerships while others were, at best, organisations sub-contracted to undertake specific project components (authors' observations of Phase I project meetings). The description of the Phase I activities in this paper continues to use the term "partner", recognising this caveat.

studies reveal important gaps that enabled the project to learn from its own mistakes (see case studies below). The project also supplemented its own experiences by undertaking a number of case studies of initiatives where fodder-related innovation processes seemed to be taking place quite successfully (see case studies below). This provided a historical perspective on the process around fodder technical change and highlighted the non-linearity of the innovation process and the range and diversity of innovations — technical, institutional and policy — required to make interventions achieve their desired social and economic impacts. Of equal importance were the insights into the operational implications for new projects that these case studies provided.

The next segment provides case studies both from the Phase I experience and from the wider set of studies the project documented.

3. Case Studies – Experiences from Phase I Interventions

Case study 1: Strategies of international agricultural research organisations in promoting dual-purpose crop varieties:[9]

Part A: Identifing systems failures

This case describes a project component on promotion of improved crop varieties and the eventual realisation that this is a task that goes beyond technology transfer.

In India, this project component was led by ICRISAT, an international research institute with a mandate for crop improvement. Having a large number of successfuly developed varieties of groundnut, ICRISAT was keen to engage in the project as a way of finding uptake mechanisms for its groundnut varieties. To this end, it began farmer participatory varietal selection trials in the major groundnut producing area of Ananthapur in the Indian state of Andhra Pradesh.

Farmers selected a variety of groundnut (ICGV 91114) that provided increased yields of both grain and fodder. However, spread of the technology from on-farm trials was not immediate despite the project's initial promotion of the varieties. This was partly due to the insufficient quantities of seed available. Although it was technically feasible for farmers to use saved seed to facilitate scaling-out, in practice their cash flow needs and difficulties of seed storage meant that the entire crop was sold shortly after harvest and new seed purchased each season. Although private sector merchants were present, they did not trade in groundnut seed because they were priced out of the market by government provision of subsidised seed.

However, even the subsidised government seed system was not helpful in getting preferred varieties to farmers. The routine practice with the government seed supply system was to make decisions on variety and quantity at the state or national level. As a result, the government seed made available did not match with the choice made by farmers in the participatory trials in Ananthapur.

[9] Source: Adapted from Prasad et al., (2006), Bezkorowajnyj et al., (2006a; 2006b), ILRI (2006a; 2006b).

At the other end of the value chain, traders could not provide an assured market of new seed unless their clients, the oil millers, were confident the supply would be adequate to justify technical and operational modifications to the oil extraction process. While dealing with these wider systems issues was beyond the scope of the project and the mandate of the lead partner in this component, it did alert the project leaders to the need to address these wider linkage and institutional issues. It also highlighted the fact that participatory farmer selection of varieties is insufficient to stimulate innovation; they might know what varieties they want, but getting those varieties and using them is a totally different matter.

Part B: Addressing systems failures

Very much like the case of groundnuts in India, the focus in the equivalent component of the project in Nigeria — led by the international agricultural research organisation IITA —was on introducing dual-purpose varieties; this time, of cowpea. While some of the contextual features of the seed system in India and Nigeria were different, similar conclusions were reached. Farmers liked the new, dual-purpose cowpea varieties introduced by the project. However, while government extension staff was aware of the high demand for the seed varieties, there were inadequate mechanisms for articulating that demand to seed suppliers.

Extension agents, and NGOs partnering with the project, looked to the researchers to provide new seed each year, but inevitably its capacity was limited. The project initiated meetings to bring private seed suppliers and extension workers together to discuss ways in which the supply issue could be addressed. However, suppliers were still not prepared to invest money in a new variety for which the demand was not proven.

Therefore, project leaders decided to initiate a new activity. Rather than continue to supply seed to partners, an agreement was made with a private company that the project would underwrite 50% of any losses resulting from poor sales of new seed they produced. This provided the incentive required for the seed company to take a risk and produce seed of the new variety for sale in the following season.

By intervening in such a way, the project helped build the capacity of the seed system by ensuring that a key actor — in this case the private sector — played a critical role in making technology available to farmers. The project thus illustrated the importance of facilitating others to become part of a system for putting knowledge and technology into use.

Case study 2: Strategies of a dairy cooperative: Institutional changes to make technology accessible to the poor[10]

This project component was led by the National Dairy Development Board (NDDB) and the associated Dairy Cooperative Societies (DCS) in the Ananthapur district of the Indian state of Andhra Pradesh. It illustrates the way that institutional changes are as important as technological changes in bringing about innovations in livestock fodder practices relevant to poor people.

[10] Source: Adapted from Prasad et al., (2008), Bezkorowajnyj et al., (2006b), ILRI (2006a; 2006b).

As a cooperative, NDDB is focused on the needs of member farmers, although these are not necessarily the poorest in the community. The project took advantage of NDDB's networks and the trust associated with these, and helped introduce institutional innovations that made NDDB a technology-supply mechanism with an increased focus on the poor.

NDDB has a well established seed production and distribution system. It always hoped that this would act as a mechanism to disseminate new varieties of fodder. The project helped to provid new materials for testing (hybrid Napier varieties for irrigated conditions and Stylosanthes spp. for rainfed areas), and uptake was then tracked. Seed was sold through the Dairy Cooperative Societies (DCS) and cuttings of Napier hybrids were provided free to farmers on the understanding that once plots were established they would pass on material to neighbouring farmers.

Project leaders held meetings with NDDB representatives and technical staff from the milk unions responsible for fodder delivery. This helped facilitate a discussion among farmers and others about the relative merits of the new fodder varieties. It also allowed a discussion of other second order problems that needed to be dealt with in order to facilitate the wider use of the new varieties and of suggestions of other possible interventions that could address the problems encountered.

One issue raised was the poor adoption rates — despite the efforts of union staff to promote the new varieties. This was initially seen as a result of farmers' lack of knowledge. However, discussions revealed that because of the diversity of both agricultural production contexts and household needs of livestock keepers, the introduced materials were not always appropriate. The NDDB officials and milk unions' fodder extension officers associated with the project began to realise that a new approach was needed. The institutional innovation that emerged from this included a greater emphasis on understanding local farmers' needs and the provision of a basket of options rather than the promotion of materials identified as promising by NDDB headquarters or the project.

It also became apparent that some of the most interesting changes that increased farmers' access to feed and fodder centred on the development of another non-technical change. It was noticed that the provision of Napier grass to farmers with access to irrigation initially excluded landless farmers for obvious reasons. However, as livestock is often an important livelihood strategy for poor, landless households as well, these farmers started to develop new arrangements whereby they leased small plots of land from landowning households. Landowners provided planting material and access to water, while the landless livestock-owning households provided fertiliser (manure) and undertook production and harvesting of the Napier grass.

Notable about this case is not just that the poor could access new seed varieties that suited their needs, but also the fact that the project was able to strengthen the capacity of the existing arrangement to respond to the needs of the poor — i.e., the changes to NDDB strategies. While institutional innovations created this new capacity, its outcome was technological change in the animal feeding system: the adoption of new fodder types by different wealth categories of farmers.

Case study 3. Institutional learning: Investing in studying the missing links in the Phase I project.[11]

This case study illustrates efforts to reveal the wider set of players that were actually relevant to the sorts of fodder-related changes that the project was trying to stimulate. The case shows the importance of investing in the investigation of the wider context in which technological change is taking place, and using this information to adapt the project approach both in terms of what sort of organisations to work with as well as the sorts of relationships needed to engage productively with these different players.

The Phase I project commissioned a study on the range of players related to the co-operative dairy sub-sector and their interactions in the Krishna and Guntur Districts of Andhra Pradesh, India — an area where the project was working with NDDB as a partner, evaluating different kinds of fodder in 15 villages. The study used an actor-linkage matrix to understand the nature and strength of linkages among the various actors.

The major findings are as follows: Although a number of actors are present, strong linkages exist only among the ILRI staff involved in the project, NDDB staff directly employed in the project, fodder officers of the Krishna and Guntur Milk Unions, and participating livestock farmers selected by the project in target villages.

While these linkages are not surprising, the study concluded that there were a number of potentially critical actors present in the area that the project should have partnered with. For example, employment programmes implemented through the District Rural Development Agency (DRDA), and Zilla Parishad (ZP) Block panchayats (local administrative structures) could have been utilised for the promotion of fodder technologies. These organisations would have brought with them a strong poverty focus. Similarly, women's self help groups (found in most villages) could have been harnessed for testing, evaluating and promoting fodder as an enterprise. Private sector seed companies, dairy cooperatives and milk vendors were also identified as important players in the sub-sector with a role to play in fodder technical change. But the project had not explored the roles of these players, nor were they included in fodder interventions.

The study concluded that the project would be more effective if it spent more time and resources on developing relationships with a range of sector-related players at the district level. The project's efforts to reveal these shortcomings is also notable (and laudable) as it demonstrated a commitment to institutional learning — in this case, how to change the scope of its partnering to improve the effectiveness of the project's intervention strategy.

Our final two case studies illustrate what fodder innovation looks like in practice. These are presented here with the specific purpose of trying to draw out some implications for how to structure interventions to deal with fodder innovation.

11 Source: Unpublished FIP – Phase I consultancy report, Prasad, S. and Rasheed, Sulaiman V. (2004) An Actor Linkage Analysis of Patterns of Interaction in Krishna and Guntur Co-operative Dairy Sub-Sector. Centre for Research on Innovation and Science Policy (CRISP).

4. Case Studies – Supplementary studies in Phase I

Case study 4. Navigating the quagmire of innovation: Livestock, livelihoods and second generation problem[12]

This case study documents the way an Indian government rural development project — titled Velegu — having chosen livestock as an entry point, had to deal with a large number of second generation challenges that subsequently arose. After introducing large numbers of high-yielding buffaloes, the effectiveness of the intervention became limited by other issues, including vet services, fodder supply, and credit. Although there was no forward planning to cope with these unforeseen difficulties, the project formed partnerships with different government departments and NGOs in order to access the resources and assistance needed to make high-yielding buffaloes a viable livelihood option.

Velegu is a Government of Andhra Pradesh Project funded by the World Bank and implemented by the Society for Elimination of Rural Poverty (SERP). Field implementation started in 2003 in Adilabad, one of the poorest districts of the state, with the objective of increasing and stabilising incomes of the rural poor through the creation of productive assets. The evolution of interventions was as follows:

Intervention 1. Provision of animals and dairy infrastructure. Velegu provided loans for the introduction of 4,000 high-yielding buffaloes to promote dairy as a livelihood option for poor rural women and invested in the installation of seven Bulk Milk Cooling Units (BMCUs).

Intervention 2. Partnering for technical support. Relations between Velegu and the government Animal Husbandry Department (AHD) — responsible for government livestock projects and technical support — got off to a bad start. Velegu went ahead and selected buffalo types without consulting the AHD about what it recommended as suitable for the area. Later, however, Velegu approached the AHD and was able to make resources available to AHD field staff so that they could provide veterinary services to Velegu's participating households.

Intervention 3. Provision of fodder. Not surprisingly, the introduction of 4,000 high-yielding buffaloes revealed fodder shortages as a major problem. Velegu worked out three different arrangements to obtain fodder – (1) promoting cultivation by individual farmers on 10-15% of their arable land; (2) forming Common Interest Groups of landless farmers and leasing land from big farmers (3) encouraging sale of fodder.

Intervention 4. Working capital credits. In most cases, the purchased buffalo was the first or only animal owned by the household participating in the project. This resulted in a breeding gap and declining milk procurement — buffaloes produce milk only after they have calved. Velegu could not advance a second loan for a second animal, so almost 70% of the programme households approached BASIX — a micro-finance company — for a second animal loan.

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[12] Source: Adapted from FIP – Phase I consultancy report by Mona Dhamankar, Centre for Research on Innovation and Science Policy, 2005.

Intervention 5. Connecting farmers to the dairy market through partnerships. Part of Velegu's strategy was to try to revive dairy activity as an additional livelihood opportunity for poor households. It was doing this in the traditional way that a development project would — paying attention to participating households' needs, but (perhaps paradoxically) paying less attention to commercial viability. Village Milk Societies were created to cover producers across 3-4 districts. Dairy managers were contracted by the government DRDA at each Bulk Cooler location and officers were appointed to collect and procure milk, test it and make payments regularly. To address the breeding gap, the dairy approached the JK Trust (a private foundation) as well as BAIF (a large livestock-focused NGO). JK Trust proposed lower milk quality and quantity targets, and as a result, was not approved by the then District Collector (the chief public administer for the district and ultimately responsible for the implementation of government programmes like Velegu). This decision, however, led to a serious drop in milk procurement, accompanied by the risk of losing the confidence of producers associated with the programme. To address this, Velegu invited NDDB to provide technical expertise to train supervisors and help set up input delivery and related support systems needed for increasing the procurement.

How did innovation take place in this case?

Partnerships – The Adilabad Velegu Project depended upon several partnerships within and outside the government in order to bring about innovations in livestock practice. A key partner was the Animal Husbandry Department, despite a rather shaky start. Partners such as BASIX were sought to bring new resources — credit, in this case. Inviting NDDB to set up procurement systems and train supervisors and testers has been a way of both tackling procurement as well as raising Velegu's credibility in the case of dairy enterprise management. These partners have often had different working styles and Velegu has had to accommodate this in order to achieve its goals and overcome emerging challenges.

Impact of the political context – When the project was initiated, the State Government in place at the time used it as an election tool towards the end of its term. A new government took over and continued implementation of the programme under a different name. However, because the earlier government representatives (now part of the Opposition) told project participants that they need not repay their loans, low recovery rates have emerged as a new challenge. This, in turn, is preventing the establishment of further support services and activities.

New challenges, new partners

The project initiated dairy activities by providing loans for high-yielding animals. Upgraded animals needed better management, i.e., regular healthcare, better/ more nutritive feeding, and also a more reliable market linkage. This led to collaborative arrangements with the AHD for veterinary services, the district administration to permit use of revenue wastelands, and NDDB to streamline dairy operations in the eight locations Velegu was implemented. It is, therefore, evident that one action (the initial loan programme for participants: the first buffalo) led to a whole series of new problems. The evolving nature of problems generated a new set of

partners — vet service suppliers, credit provided, etc. Simultaneously, there was a parallel need to make linkages to organise producers, make services and inputs available and to market the milk. Velegu teams coordinated the inputs of the various agencies involved. The anchoring role played by the project facilitated convergence between the programmes of different partners and the project.

Implications

After a number of years in the doldrums the project is starting to show some success. The case illustrates just how messy the process of livestock innovation can be. The implication of this is not just that partnership can be an essential strategy for coping with an evolving set of problems — although it has been central in moving this example forward. More importantly, the case suggests that ways of bringing about innovation need to be approached experimentally in each location. Velegu really is a story of trial and error and muddling through. Developing principles about how to structure this process of trial and error and finding ways of speeding it up could make a valuable contribution to livestock-related problems such as fodder scarcity.

Case study 5. Activism and policy innovation: The Andhra Pradesh Grazing and Fodder Forum[13]

This case documents the way a livestock-focused NGO — The Andhra Pradesh Grazing and Fodder Forum (ANTHRA) — identified a critical policy constraint affecting poor peoples' access to fodder and how they went about bringing about the policy innovation needed to resolve fodder scarcity. It is easy to forget that policy change is a key innovation, and for this to have the desired outcome it needs to result from a process with the capacity to articulate user needs in policy formulation. The case also illustrates that while emphasis needs to be given to technical and institutional innovations in the sphere of rural development around projects or other interventions at a local level, it needs also to be recognised that policy changes affect the livelihoods of poor people. This case discusses the way networking strategies were used to bring about policy changes in relation to grazing rights that affected poor livestock farmers.

The Intervention

ANTHRA is an NGO working on livestock and peoples' livelihood concerns that took the lead role in creating and coordinating an informal platform to discuss and debate livestock, fodder, grazing and livelihood issues in Andhra Pradesh, India. Representatives from NGOs, farmers' organisations, state government departments of Animal Husbandry, Rural Development, Environment and Forests, Watershed Development, Science and Technology were invited to join. Over a two-year period, ANTHRA convened meetings of groups of these stakeholders to

[13] Source: Adapted from Fodder Innovation Project – Phase I consultancy report by Mona Dhamankar, Centre for Research on Innovation and Science Policy, 2005.

deliberate on issues related to fodder security for livestock in Andhra Pradesh, and to attempt convergence among micro-level interventions addressing different components of peoples' livelihoods and natural resources. The forum also examined the "Strategy and Vision Document for Agriculture" of the Government of Andhra Pradesh, and the "Strategy Paper on Agriculture and Allied Sectors" made public in January 2000 and January 2001, respectively. ANTHRA published and circulated an analysis of the vision document that examined the implications for poor smallholders, and suggested an alternative vision and strategy for socially and ecologically sustainable livestock development.

Responding to the draft grazing policy

In 2001, the State handed over the responsibility of formulating a Grazing Policy to the Forest Department as a component of the World Bank-funded Andhra Pradesh Community Forestry Project[14]. The draft policy was anti-people in that it imposed severe restrictions on the entry and use of forest resources, including charging grazing fees. It listed all the ill effects of grazing without offering any alternative to the forest dwellers and people depending upon livestock and forests for their survival.

The forum convened a meeting to discuss the Draft Grazing Policy and the concerns raised were widely circulated to farmers and livestock keepers across the state. This meeting drew the attention of the Principal Secretary, Department of Animal Husbandry, Dairy Development & Fisheries, and motivated a letter to be written to the Principal Secretary, Department of Environment, Forests, Science and Technology with a request to withhold finalisation of the policy in consideration of the issues raised by the forum. The Principal Secretary then called a meeting of senior Forest Department officials and forum members where he was apprised of the widespread negative responses of the farmers to the draft policy. The need for formulating a grazing policy aimed at strengthening and protecting peoples' livelihoods within and outside forests was duly emphasised.

As a result, the Forest Department decided to withdraw the draft grazing policy. A government order (GO Rt. No. 78 dtd. 27/02/02) was issued for the formation of a committee consisting of a senior officer from the Forest Department, an Additional Director from AHD and with ANTHRA as a member of the forum. This committee was to interact with all the stakeholders, including local forest-dependant communities, sheep and goat-rearers, line department officials, NGOs, and relevant activist groups from across the state. The forum accepted the Government Order conditional to incorporating the grazing/fodder security policy in forest regions within the larger context of developing a fodder development and management policy for the state. It organised a consultation workshop to work out specific priority issues, strategies and a timeframe for the proposed study. All concerned departments presented their positions and suggested strategies to improve fodder resources. Consequently the policy document was redrafted as the Fodder Development and Management Policy for Andhra Pradesh.

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[14] According to the draft policy document, during the negotiations for the finalisation of the AP Forestry Project in 1993, the Government of Andhra Pradesh and the Government of India agreed to formulate and introduce a grazing policy for the State as a condition to World Bank funding.

How did innovation take place in this case?

The AP Grazing and Fodder Platform emerged as an active network of different players, each with a different stake in the question of the forest and grazing policy and each seeking an opportunity to influence policy development. Influencing policy is a tenacious process and each actor, while constantly learning about the other actors' perspectives, priorities and limitations, realised progressively that their roles were part of a larger social endeavour. Identifying and inviting players who had specific knowledge or political consistencies that could affect policies, and recognising that these players need to be brought into a process of redrafting a policy document, is a key feature of the process of bringing about this policy innovation. Indeed, this case is as much about an innovation in the policy process as it is about a policy innovation. This underscores the interconnectedness of policy processes and policy change.

The case also reveals the way the roles of players changed to bring about this sort of innovation. The government's policy-making bodies took on a much more consultative role, while unusually, NGOs and activity groups were faced with navigating the complexities of different interest groups in their coalition for policy change. ANTHRA obviously played a special role, acting as a champion and coordinator of a process that clearly would not have happened through the actions of either only the government or the NGO groups involved. ANTHRA was not the only champion. Quite clearly the Principal Secretary, as the seniormost Government bureaucrat involved, played an enormously important role in legitimising the consolations and negotiations that led to policy change.

Implications

In short, what this case shows is the way that innovation — even policy innovation — requires the shepherding of different players, with different resources and knowledge in a coalition around a common purpose as a way of better reflecting user needs in the development process. ANTHRA did not have a plan on how to do this. Its actions were an intuitive response to the situation it found itself in and it muddled though the difficulties of developing an effective policy advocacy coalition. Once again, understanding how to structure and speed up this muddling through would help others tackling similar policy-related fodder constraints that affect poor livestock keepers.

5. Lessons and principles from this Phase I project experience

The experiences of the Phase I project as well as the additional case studies of fodder innovation provide many useful insights to help guide future investigation of fodder innovation. The key lessons and principles are as follows:

Participatory research is useful, but not sufficient for innovation

At the beginning of the project, participatory research was the state-of-the-art answer to the agricultural innovation conundrum. The groundnut case study 1 showed that even though participatory methods helped identify the varieties most preferred by farmers, this did little

to help them actually access this new technology and put it into use in their fields, since the architecture of seed supply systems was either absent or insensitive to identified priorities.

Technology delivery and use requires networks of diverse players

Both the groundnut initiative in India and cowpea initiative in Nigeria in case study 1 demonstrated that for effective technology development, adaptation and delivery, a network of players who function in an articulate way is required. In this case, it involved seed suppliers, extension agents, private seed companies, legislators, oil-seed millers, and market traders. The players may be different for different innovation themes (For example, those associated with co-operative dairying illustrated in case study 2 and 4). Whoever they are, without a cohesive network of linkages, technical change seems to be inhibited and the innovations needed for social and economic impacts do not take place.

Facilitating wider interactions can stimulate institutional innovations that sharpen impact on poor stakeholders

Project interventions can inadvertently put in place arrangements that either do not work or that work in ways that ignore the concerns of certain social groups — usually the poor. Case study 2 illustrates the way two project partners were promoting Napier grass provided by the project, but were doing so in a way that resulted in very limited uptake. This was mainly because the organisations, both with fairly strong top-down traditions, were not adequately consulting livestock keepers about their preferences and needs. The project facilitated a discussion between these different players. As a result, the project shifted from promoting only one variety to promoting a menu of options. This improved uptake considerably.

Institutional learning helps improve project strategies

Unlike many projects, the Phase I project actually invested resources to help itself learn. The project team realised that the original project design was not as effective as it might have been. It then made explicit efforts to document experiences and processes in its own activities — this was the basis for cases 3-5. It commissioned additional studies on the scope of its partnering to see how its strategy could be improved and explored experience beyond the project. These explicit measures helped the project devise ways of improving the way it addressed fodder scarcity. This is a process often referred to as institutional learning (Watts, et al, 2003). This would suggest that projects need to invest in this process and use it for continuous course corrections.

Different organisations have different agendas, mandates and traditions

As the different project initiatives started to expand, and the number of partners involved also grew, the different habits and traditions of the organisations came into play. For example, government departments have a top-down way of working, whereas NGOs usually — although

not always — are more client-oriented (see the case of the dairy co-operative initiative in case study 2). These different working styles can prevent critical partners working together and interacting productively; there is no point in partnering with an organisation that ignores your ideas and opinions. Changing these styles of working, sometimes referred to as a process of institutional learning or institutional development, can improve the effectiveness of interventions.

Shifting from technology transfer to capacity strengthening

As the different project activities proceeded, it became apparent to the project team that while viable technologies were important, more important still was the creation of a network of players that could deliver and use the outputs related to those activities. The initiatives led by international agricultural research organisations discussed in case study 1 show the way the project shifted to facilitate linkages in systems in order to deliver the technologies developed by these partners. The dairy co-operative example in case study 2 showed the way it was necessary to get organisations to change the way they worked, both in order to be sensitive to the needs of poor stakeholders and also to allow collaboration to take place between different players. The policy innovation example in case study 5 shows how it was important to develop coalitions for advocacy and change.

All of these actions actually concerned strengthening the capacity of a network of players to access, adapt and use technology and bring about changes in fodder availability and use. This shift — undertaken intuitively by the project — is very important as it signals the fact that the fodder-related innovation process, while requiring technological (and other knowledge) inputs, is actually dependant on capacity changes. And this capacity is not just the technical skills held by particular organisations. Rather, it is a combination of: skills and resources; relationships for collaboration, cohesiveness and communication between different organisations, including farmers in the public and private sectors; the habits, routines and ways of working (the institutions) that shape the pattern of relationships between different organisations and how this shapes the way things are done in relation to technology and innovation.

At the risk of overlabouring this point, the experiences of the Phase I project clearly point to the fact that fodder scarcity is not a problem of technological scarcity that can be overcome by technology transfer alone. Rather, it is a problem of innovation capacity scarcity relating to the ability of the many different players, processes and policies associated with livestock sectors to bring about technological, institutional and policy changes in response to changing circumstances. And in this case those changes may be the availability of new fodder technology, changes in animal production systems, changes in degrees of market integration, and with this, changes in demand for quality and price. The implication of this is that the problem of fodder scarcity needs to be addressed from the perspective of investigating shortcomings of existing capacity (in this wide sense) and experimenting with ways of strengthening this capacity. This is precisely what the Phase II project will do. Section II is devoted to locating the empirical findings of the Phase I project in the contemporary conceptual debates about innovation and thus providing a guiding framework for investigating empirically the nature of fodder innovation capacity[15] and ways of strengthening it.

[15] The project documentation uses the term fodder innovation capacity. The authors have some discomfort with this term, as by definition the innovation capacity being investigated relates to the ability to bring about changes in a number of different aspects of the livestock enterprise — and not only fodder — in response to changing contexts. However, for consistency, this paper uses the term fodder innovation capacity, recognising this caveat.

Operational lessons

By way of summary it is worth highlighting some operational lessons from our discussion of Phase I of the project.

Process-driven investigation. As a number of the cases show, the process of innovation is far from linear, often due to unexpected second generation challenges and opportunities emerging, or with mid-course corrections being required. Case studies discuss this as "muddling through". To investigate how to strengthen the capacity that underpins this process, a process-driven approach is required. This suggests that an action research approach should be used.

Principles rather than a capacity blueprint. The cases discussed suggest that ways of bringing about innovation need to be approached experimentally in different locations and that ways of bringing about institutional change needed for capacity strengthening will also have a very location-specific flavour. This suggests that a project investigating fodder innovation capacity should seek to develop principles rather than formulaic blueprints. Operationally, this means that the research design will need a strong comparative element so that generic principles can be drawn from contrasting experiences and cases.

Wider scope of partnership. The Phase I project concentrated on a relatively limited number of partners in each intervention domain. The evidence of the study reported in case study 3 suggests that this needs to be expanded. Operationally, this means that the new project should concentrate on facilitating the emergence of clusters of partners around perhaps a nodal partner in each location with an explicit responsibility for coordinating the involvement of linkages. The experience of the early project suggests that identifying champions who are willing to experiment with the new approach will be critical. See, for example, the role of NDDB in case study 2 or ANTHRA in case study 5.

Building partnership skills. Since partnership is a central part of the approach, the project will need to invest in building up the partnering skills of those it works with. However, like charity, this process should start at home with the project team. For example, the project development process, conducted without consultation of those it seeks to work with, leaves a lot to be desired in terms of working in a genuine partnership mode.

Engaging with the policy process. The Phase I project made no attempt to bring about policy changes that might lead to scaling up of its efforts. The example of ANTHRA's platform for policy advocacy (see case study 5) suggests that not only is policy innovation important, but also that the way of engaging the policy process is to build platforms with wide participation from both the fields of policy and practice. This means that a project on fodder innovation needs to be wide enough in scope to deal with both the enabling environment that may be impeding fodder innovation in specific contexts and locations, as well as the processes that come up with these policies.

SECTION II: A FRAMEWORK FOR ANALYSIS

1. The Generic Problem of Translating Agricultural Research into Innovation

The problem of translating fodder-related research and technology development into improvements in fodder availability in different animal production and marketing environments is not a unique one. Evidence suggests that agricultural research has largely failed to make its promised contribution to social and economic development. There is now broad agreement that research-led technology transfer is ineffective in bringing about innovation. Here, we use the term innovation to refer to the whole process by which knowledge is created, diffused, accessed, adapted, and, most critically, put into use.

From decades of agricultural research and technology promotion experiences[16], a number of important principles have emerged. These are summarised by Hall, et al (2007) as follows:

(i) Despite the planning emphasis on setting up specialised research centres for developing agricultural technology, success rarely takes place unless technology users are consulted and involved in the R&D process from a fairly early stage.

(ii) Technology development is only a relatively small component of the larger process of technology production, supply and use — i.e., the entire innovation process — and technical change often requires complementary changes in, for example, the organisation of production or marketing of products. As a result, interaction within a diverse set of players, who embody different information and skills, is required for innovation to take place.

(iii) While innovation may involve radical technical changes such as a new crop variety, animal breed or a new type of machine, it is usually a series of incremental changes — tinkering, adaptation and creative imitation — in technology, organisation or strategy.

(iv) Innovation can be triggered in many ways, not just by research; for example, changes in policy; patterns of competition and consumer demand; pest and disease outbreaks; and international trade rules or domestic regulations.

(v) Technology delivery processes need to adapt to the agricultural, market and livelihood conditions prevailing in specific contexts at specific points in time — in other words, there

[16] Biggs and Clay (1981); Biggs 1990; Chambersand Ghildyal, 1985; Richards, 1985; Byerlee andAbex, 1998, Hall et al. 2001, World Bank 2006; Hall, 2006.

is not a one-size-fits-all recipe for this. As a result of this context specificity, local processes of experimentation and learning assume great importance in the innovation process.

(vi) It is the institutional context of technology development/ promotion initiatives — i.e. the combinations of different organisations, and the roles, routines and rule sets associated with them — that determine the extent to which these wider processes operate effectively and thus whether innovation is enabled or not. If welfare of poor households is to be addressed by innovation, specific institutional and governance innovations are usually required.

It is becoming increasingly apparent that institutional contexts, because of their centrality to the innovation process, determine the extent to which agricultural technology-related interventions result in technological change (Biggs 1990, 1995; Hall et al. 2002, Hall et al 2003; Watts et al 2003). Institutional settings thus determine whether agricultural technology contributes to the development process. An important point of departure in contemporary thinking on the production and use of knowledge is the recognition that institutional factors are a central component of capacity (Edquist, 1997; Oyelaran-Oyeyinka 2005, Fukuda-Parr et al 2002). These perspectives resonate with the empirical findings of Phase I discussed in Section I of this paper. These are also perspectives that reflect recent thinking associated with the use of the analytical concept based on the notion of an innovation system. Before explaining the historical development of this concept and its key analytical insights, it is useful to first locate this perspective within the changing paradigms of agricultural research over the last 40 years or so. This helps highlight the key points of departure and the additional analytical insights that the innovation systems concept will contribute to this study.

Why is Agricultural Innovation so Difficult?

Agricultural innovation in developing countries presents some particular problems. In contrast to the industrial value chain, agricultural production is different in four major respects, as detailed below.

(i) The production context (agro-ecological conditions) is highly variable both between locations (soil type, climate) and over time (pest incidence, markets, climate).

(ii) This heterogeneity is compounded by the fact that the sector is made up of very large numbers of uncoordinated production units, namely farmers. Social variability — wealth, gender, ethnicity, individuality — is also very high. This means that technology and innovation need to address multiple and often micro agendas and application contexts, thereby reducing the effectiveness of strategies that rely on the centralised development of generic technologies.

(iii) Much of agricultural technology is embodied in biological material (new seed varieties or animal breeds), which, being highly sensitive to production conditions, tends to compound the problems of production heterogeneity.

(iv) Due to the perceived importance of agricultural research as a public good, policy emphasis has tended to stress the separate roles of public and private sectors. This has been based on the misplaced idea that public goods should not be sullied by the profit-driven private sector. However, paradoxically, public policy has often falsely assumed that the market can act as

an effective mechanism for the development and delivery of certain types of agricultural technology. Policy has thus reinforced the division of labour between the public and private sectors and has consequently missed opportunities for collaboration toward innovation.

2. Evolving Paradigms of Agricultural Innovation

The recent focus on innovation and the use of ideas like the innovation systems concept is relatively new to policy and other forms of support to the agricultural sector in developing countries. The traditional focus in these countries, and in donor assistance to them, has been on building the capacity of agricultural research systems and related technology transfer arrangements, as well as providing operational funds for these. Over the last four decades, agricultural innovation has revealed itself to be much more difficult than initially assumed. While there have been many critiques of the research-led technology transfer approach it is useful to recognise that approaches have evolved over time with a number of distinct paradigms apparent. The characteristics of these different paradigms are summarised in Table 1.

Table 1. Characteristics of Different Paradigms of Agricultural Innovation

Paradigm	Transfer of Technology	Farming Systems Research	Farmer First / Farmer Participatory Research	Interactive Learning for Change/ Innovation Systems
Era	Widespread since the 1960s, but building on a very long history	Starting in the 1970s and '80s	Starting in the 1990s	Work in progress
Organisational focus	Agricultural research laboratories and field stations arranged as National Agricultural Research Organisations, with a separate agricultural extension service	Agricultural research organisations arranged as part of a National Agricultural Research System (NARS) with a separate agricultural extension service	NARS as part of a Agricultural Knowledge and Information System (AKIS) including agricultural extension and education organisations	NARS as part of agricultural innovation systems
Mental model of activities	Supply through pipeline	Learn through survey	Collaborate in research	Interact and learn for innovation
Farmers seen by scientists as	Progressive adopters, laggards	Objects of study and sources of info	Colleagues	Key actors among many others
Farmers' roles	Learn, adopt, conform	Provide		

...Continued

Table 1. *Continued...*

Information for scientists	Diagnose, experiment, test adapt	Co-generate knowledge, processes and innovation		
Scope	Productivity	Input-output relationships	Farm-based	Beyond the farm gate
Core element	Technology packages	Modified packages to overcome constraints	Joint production of knowledge	Facilitated interactive innovation, learning and change
Driver	Supply push from research	Scientists' need to learn about farmers' conditions and needs	Demand pull from farmers	Responsiveness to changing contexts
Key changes sought	Farmer behaviour	Scientists' knowledge	Scientist-farmer relationships	Institutional, professional and personal, affecting interactions and relationships between all actors
Intended outcome	Technology transfer and uptake	Technology produced with better fit to farming systems	Co-evolved technology with better fit to livelihood systems	Enhanced capacities to innovate
Innovators	Scientists	Scientists adapt packages	Farmers and scientists together	Potentially all actors
Intervention mode	Core funding of research and research infrastructure development			Strengthening systemic capacity to innovate
Role of policy	Set priorities and allocate resources for research			Embedded part of innovation capacity

Source: Hall et al 2007 cited as adapted from an unpublished note by Robert Chambers and Andy Hall and other, Montpellier IAASTD meeting, 2005.

There are perhaps two points about the changes illustrated in Table 1 that are worth emphasising. The first is that the technology transfer paradigm has been questioned by scientists and social researchers since at least the 1970s. In other words, the question of how to organise the process of agricultural innovation has been with us for a long time. The fact that fortunes of some of the technology transfer and alternative paradigms have waxed and waned, however, does not necessarily mean that they should be judged inferior. Indeed it has been argued that the technology transfer paradigm was quite sufficient for the food production strategies required in the development scenario of the 1960s and '70s. The fact that the development scenario has become much more multidimensional and that markets, technology and agendas are changing much more rapidly and that new players, particularly the private sector, have emerged means that the old technology transfer paradigm is simply no longer adequate (Hall et al 2001).

Nevertheless, farming systems and participatory research paradigms were important institutional innovations and helped build up further knowledge on the relative merits of alternative ways of organising the innovation process. These models, in many senses, laid the foundations for the innovation systems paradigm. They legitimised the role of technology users in the innovation process; they recognised that innovation draws information from multiple sources; they championed the idea of participation; and they saw how action research could be used to explore development phenomena that are complex and evolutionary in nature.

While the actual idea of an innovation system emerged in parallel with economic studies of industrial countries, its central ideas resonated with the institutional innovations taking place around agricultural research approaches in the 1990s. Moreover, there are many parallels between the economic context of industrial countries and those now faced by developing countries: increasing exposure to global markets, and with this, increasing competition and ever more stringent quality standards. As a result there is a need to deal with the development scenario that is changing rapidly and in unpredictable ways. Of course, social equity and the need to improve the livelihoods of poor rural households in developing countries is an additional and unique concern for agricultural development policies. Innovation system ideas, however, brought fresh thinking and impetus to the discussion of agricultural science, technology and innovation in development that had, in many senses, got stuck and had, to a large extent, slipped off the agenda of many development agencies.

The second and arguably most important point about the changing paradigms is the gradual shift from technology delivery to capacity enhancement and, specifically, the capacity to innovate. Underlying this is the idea that in order to be effective in an ever-changing world a continuous process of innovation is required to adapt the economic process to presenting situations — for example, livestock disease outbreaks or changing consumer preferences. As a result, it is not technology per se that is important, but the ability to adapt — often through technical or design changes — to meet the new demands of production conditions, markets or technology users. The caveat is that changes in ways of working (institutional innovations) go hand in hand with these technical and design changes and thus the propensity for institutional learning and change is central to innovation capacity. This is a considerable break from the linear technology-led way of promoting innovation

This is where the innovation systems perspective is particularly valuable because it is a way of conceptualising capacity in terms of the different players, processes, skills and resources that are needed to allow innovation to take place on a continuous basis. This is a major departure from earlier agricultural innovation paradigms. To make the same point differently, the innovation systems perspective shifts the underlying premise of agricultural development interventions from framing them as a problem of information and technological scarcity on production, processing or markets, to framing it as capacity scarcity in relation to the ability to innovate.

3. Analytical Insights from the Innovation Systems Concept

The concept provides a number of key policy and analytical insights that have relevance to the nature of capacity development[17].

Focus on innovation: In contrast to most economic frameworks, which focus on production (output), the innovation systems framework focuses on innovation processes. Innovation is often confused with research and measured in terms of scientific or technical outputs. However, the framework stresses that innovation is neither research nor science and technology, but rather the application of knowledge (of all types) to achieve desired social and/ or economic outcomes. This knowledge may be acquired through learning, research or experience, but until applied it cannot be considered innovation. These processes of learning and acquiring knowledge are interactive, often requiring extensive links among different sources of knowledge. The implication is that capacity development needs to focus not just on enhancing the ability to produce knowledge, but also the ability to put it into productive use.

The role of institutions: Institutional settings play a central role in shaping the processes critical to innovation: interacting, learning, and sharing knowledge. Again, the meaning of institutions is often misunderstood. The innovation systems framework distinguishes institutions from organisations. Organisations are bodies such as enterprises, research institutes, farmer cooperatives, and government or non-government organisations (NGOs), while institutions are the sets of common habits, routines, practices, rules or laws that regulate the relationships and interactions between individuals and groups (Edquist, 1997). Because institutions shape innovation, institutional change is a large element of capacity development.

The role of policies: Policies are also important in determining how people behave. However, an environment that supports or encourages innovation is not the outcome of a single policy but rather of a set of policies that work together to shape innovative behaviour. Furthermore, habits and practices interact with polices. Therefore, to design effective policies it is necessary to take into account the habits and practices of the people affected (Mytelka, 2000). For example, the introduction of more participatory approaches to research is often ineffective unless the habits and practices of scientists are also changed. Capacity development therefore needs not only the clusters of policies needed to support innovation, but also the interaction of these with institutions. This hints at the embedded, context-specific nature of capacity.

Stakeholder involvement and demands: The framework stresses the importance of including stakeholders and of making organisations and policies sensitive to their agendas and demands. Demand shapes the focus and direction of innovation. It is articulated not simply by the market but also by non-market drivers, such as collaborative relationships between the users and producers of knowledge. Demand for certain sorts of innovation can also be stimulated by policy — for instance, by providing incentives to adopt a certain technology or management practice. This can be especially important where key stakeholders are poor and have limited social and economic power or where the negative environmental impact of development needs

[17] This section draws heavily on the lead authors earlier published as Hall, et al 2005 a background paper (World Bank, 2006).

to be addressed. Skills and institutional settings needed to create stakeholder involvement are thus part of capacity.

The dynamic nature of innovation systems: The habits and practices that are critical to innovation are learnt behaviors that may change either gradually or suddenly. They are often ¬enshrined in institutional innovations, such as farmer field schools or participatory plant breeding that emerge through scientists' experimentation and learning. These new approaches to research and ¬development often require not only new ways of working but also new partners. Thus capacities develop in incremental ways through learning. However, a key element of capacity is the ability to reconfigure approaches and patterns of partnership to deal with changing circumstances.

Changing in the face of change: One characteristic of a successful innovation system is that its component organisations tend to create new partnerships and alliances in the face of external shocks. Examples of such shocks might be: a new pest problem that requires collaboration between a different set of scientific disciplines; the advent of a new technology, such as GM crop varieties, which requires the formation of partnerships between the public and private sectors; or changing trade rules and competitive pressure in international markets, which creates the need for new relationships between local companies and research organisations. It is not possible to determine the kinds of networks, links and partnerships that will be needed in the future as the nature of future shocks is, by definition, unknown. The way to deal with this is to develop capacity that creates the flexibility in working habits and institutions that allows dynamic and rapid responses to changing circumstances.

There is as yet no accepted definition of the term innovation capacity, but it captures the creative and non-linear events that sustain the change process. In a similar vein, more than a decade ago Bell and Pavitt, (1993) used the narrower term technological capacity. They contrasted research capacity and technological capacity, stating that the former concerns the resources needed to conduct scientific research. In contrast technological capacity concerns the resources needed to manage technical change — including skills, knowledge and experience (scientific, but also entrepreneurial), institutional structures and linkages or networks connecting science, consumers, entrepreneurs, intermediary organisations and policy bodies.

The innovation capacity concept recognises these same broad sets of skills, links and structures, but does so in relation to the total process of producing, accessing, diffusing and, most importantly, putting into use knowledge in socio-economically useful ways (Table 2). It stresses that institutional settings (including the policy environment) are a critical part of this capacity and that capacity development is often an issue of institutional and policy change. Innovation capacity is thus an embedded capacity that cannot be understood or developed without considering its contextual setting. Furthermore innovation capacity is a dynamic capacity not just concerned with systems, linkages and institutions as they exist today, but also with the ability to reconfigure these arrangements in response to changing demands and circumstances. As Clark (1995) points out, the need is to understand capacity in terms of holistic evolutionary systems of learning and change, where future states were unknown and unknowable.

Table 2. Similarities and Differences between Agricultural Research Capacity and Agricultural Innovation Capacity

Institutional Features	Agricultural Research Systems	Agricultural Innovation Systems
Guiding agenda	Scientific	Sustainable and equitable development
Role of actors	As researchers only	Multiple and evolving
Relationships involved	Narrow, hierarchical	Diverse, interactive
Partners	Scientists in agricultural research organisations and other public agencies such as universities	Evolving coalitions of interest. Various combinations of scientists, entrepreneurs, farmers and development workers from the public and private sectors
Policy focus	**Narrow**, related to agricultural research and agriculture and food policy. **Disconnected** from other policy domains	**Broad**, also inclusive of trade, rural development, industry, environment, education **Integration and coordination** between many policy domains
Policy process	**Disconnected** from actors and knowledge in the research system	**Integrated** with actors and knowledge and sensitive to agendas in the innovation system
Knowledge produced	Codified Technical/scientific	All forms of codified and tacit knowledge
Indicators of performance	**Short term:** scientific publications, technologies and patents **Long term:** patterns of technology adoption	**Short term:** institutional development and change / new behaviours, habits and practices/ patterns of linkage **Long term:** social and economic transformation
Responsibility for achieving impact	Other agencies dedicated to extension and technology promotion	All partners in the innovation system
Capacity development	Trained scientists and research infrastructure	Training and infrastructure development related to a range of research and economic activities and people Policies, practices and institutions that encourage knowledge flows, learning and innovation among actors in the innovation system

Source: Hall 2005

A working definition of the concept of innovation capacity might be as follows:

"The context-specific range of scientific and other skills and information held by individuals and organisations and the practices and routines (institutions), patterns of interaction and policies needed to create and put knowledge into productive use in response to an evolving set of challenges and

opportunities. A large element of this capacity arises from learning-by-doing, whereby organisations engaging in the innovation process continuously adapt ways of working and routines — institutional learning — thus incrementally improving their ability to utilise knowledge and information." (Hall, 2007—Global STI forum paper Washington 14-16 Feb 2007)

The generic elements of agricultural innovation capacity might resemble the following[18]:

- National culture appreciative of the value of the scientific knowledge in enterprise and development
- A critical mass of scientists trained in biological science and the scientific infrastructure and funds to productively employ them in research and development roles in the public and private sectors. (This would include the training organisations needed to create this human capital)
- A range of players with different types of agricultural knowledge, codified and tacit, in the public, private and NGO sectors
- Linkages between key sources of knowledge and the social capital needed to allow new linkages to be brought into play when needed
- Relationships and institutions (including habits and practices) that support dialogue, knowledge access, sharing, and learning between different sources of knowledge; between different interest groups including the poor; and between policy actors, practitioners and researchers
- A range of skills in research and entrepreneurial organisations including: scientific, technical, managerial entrepreneurial skills and skills and routines related to partnering, negotiating, consensus and learning
- Clusters of supportive policies that allow both the production of knowledge (i.e., science and technology policy) as well as the productive use of that knowledge (i.e. market and trade policy, investment incentives, regulatory regimes, bio-safety protocols; IPR)
- Change management competencies and mechanism to help predict and cope with evolving innovation environments (i.e., technology foresight). This will include the ability to link scientific knowledge to policy, problem-solving and long-term planning
- Coordination and facilitation mechanisms (i.e., sector associations, development authorities or boards) and incentive and support structures (i.e., subsidies, credit) to strengthen systems coherence in the absence of market signals
- Policy capacity to plan and promote innovation as a systemic phenomenon

4. What will fodder innovation capacity look like and how can it be strengthened?

To give operational focus to the Fodder Innovation Project's investigation of innovation capacity, it is probably not particularly useful to think in terms of a national fodder innovation system. A more useful approach would be to think of loose networks of livestock and fodder-related

[18] This list is adapted from Hall 2005.

players in the domains in which project partners are working. The project partner would form a node around which other players would be coordinated. The precise nature of the players in this network will be dependant on the particular focus of the project partner. So, for example, the players related to innovation in a nomadic pastoralist system are likely to be very different from those in a cooperative dairy system. It is anticipated that players in this loose network will be from the public, private and civil society sectors — including livestock keepers — and that these players will be related to livestock production, marketing and related services as well as to development agencies working with livestock-dependant poor people.

The term 'loose' is important here as this does not mean that this capacity will be a set of rigid partnerships, nor does it mean that the boundaries are fixed. Rather it will resemble a fluid cloud of players — an innovation cloud — some of whom will connect together at particular points in time in response to particular needs and innovation tasks. It may be around seed supply, around market access or around dealing with animal disease outbreaks, for instance. There may be a number of firm connections within a particular cloud and new players may become part of that cloud.

This innovation cloud would ideally also have connections to research and policy bodies at a national level that may be geographically distant (although not necessarily dependent on location). Market links could also connect to organisations/players, environments, opportunities and challenges beyond the immediate scale of the project. In other words a fodder innovation system would have a nucleus of dense interactions in geographic proximity to a project partner's intervention domain — what we are calling an innovation cloud. However, connections to national and even international research and policy bodies and the market would also be a critical part of this capacity. A national fodder innovation system would, therefore, be made up of a collection of these dense interactions. This might be viewed as the architecture hardware of this capacity.

However, of equal importance is the software of fodder innovation capacity outlined in principle in the list above. This is really the largely invisible things that pattern how organisations and people do things, and most critically in relation to innovation, how these interact to share knowledge; how they create and adapt knowledge; how they learn; and how they take risks.

What are these invisible things? Confusingly referred to as institutions, these are the usually unwritten set of rules that guide us all: for example, an organisation might have a very top-down working style and this will prevent it interacting effectively with other players in an innovation cloud. A research organisation might have a tradition of focusing on technology promotion through demonstration, when actually the nature of the fodder problem is access to credit to buy fodder. The private and public sectors often have a tradition of mistrust and this prevents them working together. NGOs might have a habit of participating in development projects with research organisations simply to access technologies and they may not be interested in working on projects that explore how projects learn from mistakes. Other organisations might have a habit of hiding mistakes and this can prevent them from learning.

As can be seen, institutions are a very diverse set of social incentives, but are clearly critical to the effectiveness of the architectures associated with the innovation cloud and its links to other players and contexts. It is anticipated that a fodder innovation capacity will include an institutional setting that is conducive to the critical innovation processes mentioned above. The precise nature of these habits and practices is difficult to predict in advance. Following the logic of the innovation systems concept one should not get particularly fixated on "ideal ways of working". Rather the concept would anticipate that the ability to change habits will be a more critical factor and hence the habits about practices that facilitate institutional learning and change (ILAC) may ultimately be more important (this is discussed in Section III of this paper, which reviews tools and methods). Building ILAC processes in combination with the creation of appropriate links is anticipated to be the main way of strengthening innovation capacity.

The final elements of innovation software are the incentives and other devices that pattern behaviour and are found in the wider policy and institutional environment at a national level. The question of which policies and institutions — beyond the obvious ones relating to R&D and livestock sector development — are likely to affect the enabling environment for fodder innovation is largely an empirical one and will have to be investigated by the project. However, it is anticipated that these may include not only policies related to common property resources and waste land development, but also those related to the regulation and promotion of milk marketing. Also, understanding how policy change takes place is equally important as formulating new policy recommendations. By extension of this policy research should be an interactive process whereby key stakeholders are closely involved and where there is interaction between field level results, policy imperatives, and different stakeholder agendas as well as the wider set of institutional settings that shape behaviour and mediate or skew the outcomes of different policy initiatives. Principles on how to conduct research in this sort of interactive way still need to be developed and insight into what these might be would be a valuable contribution to rural development.

5. Where do institutional innovations come from?

Since the preceding conceptualisation places such strong emphasis on the role of institutional innovations in strengthening innovation capacity, it is worth considering how these emerge. In traditional development practice these have emerged through centrally planned schemes and projects; for example, a new extension approach; new seed laws or seed systems; new tertiary agricultural education arrangements; new rural credit schemes. Almost inevitably these scheme-based institutional innovations have been generated externally (to a specific rural area or often the specific country). And, almost inevitably, these have failed.

It is now well established that technical innovations and institutional changes need to emerge from — and only have meaning in — particular social, historical, economic and political settings (Brass 1982, Biggs 1990). In reviewing a number of cases where unexpected institutional innovations have arisen out of projects, Biggs (2006) observes that "there were no 'spontaneous developments', 'hidden hands' or 'natural' evolutionary processes that gave rise to institutional

innovations and change. There were continuous political/cultural battles taking place, with effective people and coalitions taking actions to bring about changes in power structure." He explains that where social inclusion is part of the agenda of influencing local/ project actors, institutional innovations that support the poor can occur, although rigorous and continuous analysis of outcomes on the poor is required to ensure this and support the scaling-up of such innovations.

The innovation systems conceptualisation is very much in line with these perspectives, arguing that institutional changes are often a learnt response to new information or changing conditions; and that institutional innovations are often a way of bringing about technological innovation. For example, reviewing the promotion of small scale irrigation technology in Bangladesh, Hall et al (2007) explains how the success of the programme was largely a result of institutional innovation around pump quality standards. The NGO running the programme initially insisted on promoting a high quality, but also relatively expensive, pump that could last seven years. However, noticing that copycat fabricators were producing and selling a "cheaper and just about good enough" pump that only lasted two years, the NGO changed its strategy to promoting a range of different priced pumps with different qualities. The lowest quality pump proved the most popular and, of course, this was the pump of choice for households with the lowest spending power — and the target of the NGO's programme.

What this means for a project investing innovation capacity is that rather than testing out different institutional models — the usual approach of many development projects — the focus of the project should be on experimenting with ways of stimulating institutional innovations and identifying "spontaneous" institutional innovations for up-scaling. The approach also needs to be aware of the fact that these institutional innovations may be changing that bring up-scaling into wider practice either like the Bangladesh case or by changing approaches taken by government schemes.

6. Research Hypothesis on Fodder Innovation

In the initial design of this project a number of stakeholders felt that the project should test two contrasting hypotheses:

A. The entry point for strengthening innovation capacity is new technology — for example, a new fodder variety.
B. The entry point is to create capacities as technological solutions already exist.

These hypotheses would clearly have implications for the choice of case study (ILRI 2006b). Now that the conceptualisation of the project has been more fully elaborated in this paper, these contrasting hypotheses seem less relevant. This is because the research question is now framed as one about capacity and the institutional changes needed to develop this capacity. The Phase I project (discussed in Section I of this paper) illustrated that with technology as an entry point, institutional changes were required to embed and utilise this knowledge in a system of innovation. The need for institutional change is therefore now a given and this points to the

need to take a lead from a diagnosis of gaps in innovation capacity in a particular location and the identification of any positive institutional changes that warrant further development and promotion. This diagnosis will define the entry point. It is anticipated that in some cases it will be technological; in some institutional; and in others a more likely combination of the two.

The word entry point — actually starting point — is important here. The project's conceptualisation predicts that problems will reveal themselves more fully. However, as different capacity gaps are resolved, this, in combination with the changing contexts that interventions are likely to encounter, will lead the project in a different direction. Thus, the initial starting point will have little relevance as an analytical parameter.

Instead, the variable for comparison in the project will be location diversity, as sufficiently generic principles can only be derived by a comparative analysis of approaches to institutional change and capacity development in different contexts. CRISP (2007), in their development of partner selection criteria for this project, define this diversity in terms of three characteristics: (i) organisational types (public, private, NGO); (ii) fodder regimes (embodies agro-ecological and social diversity); (iii) degree of market integration (covering commercial to subsistence spectrum). They go on to stress that, "There is no indicator of diversity of individual organisations. What is required, however, is that sufficient diversity is created across the selected partners, remembering that the selected partner will form the nucleus of a number of clusters or coalitions of organisations and individuals around specific innovation themes."

The **formal hypothesis** for this study is as follows:

'Generic principles on how to strengthen fodder innovation capacity can be derived by experimenting and learning from institutional and policy change processes across the local to national levels in India and Nigeria that are inclusive of the livelihood needs of livestock dependant poor people.'

'Fodder innovation capacity will be strengthened when institutional and policy change enable a continuous process of framing and reframing of the way fodder-relevant knowledge is created, diffused, adapted, shared and put into use in ways that are inclusive of the livelihood needs of livestock-dependent poor people.'

Measuring innovation capacity development and its value

We have put forward the argument in this paper that a better way to address fodder scarcity than the usual technology transfer approach is to concentrate on building the network of linkages and associated institutional developments needed to enable innovation. Our bigger argument being that if innovation is enabled, welfare outcomes – hopefully positive – will be felt by livestock-dependent poor people. We bolster this argument by saying that we are not just going to identify the institutional changes that can enable innovation, but specifically those changes that will make processes and outcome more relevant to the poor. How do we prove that this approach is actually working better than existing alternatives and how do we know when we have "better" innovation capacity? Of course there are huge amounts of well-documented

empirical evidence that underpin the general principles embodied in an interactive approach to innovation that we are adopting and the sort of institutional changes we are seeking to bring about — for example, participation, inclusiveness, and so forth. But it is still worthwhile setting out the logic that would create that proof and explaining what that proof would look like.

The counterfactual approach

The term counterfactual is used by economists to mean the outcome of a similar situation without the project intervention. Biological scientists call this a control, and in laboratory experiments it is feasible to create a scientifically convincing design with a 'without situation'. In clinical trials the counterfactual is the double blind placebo. The counterfactual approach to project evaluation was championed, among others, by Gittinger (1982) and his 'with and without' appraisal techniques. The simple logic behind this is that the marginal social and economic benefits of a "with" situation could be compared to those of a "without". Judgments could then be made of the cost/benefit ratio of the intervention.

However, even in a fairly straightforward situation of examining what would have happened with and without, for instance an irrigation scheme, it is extremely difficult to try to control for pre- and post-project conditions in two different locations. Impact assessment of returns to investment in research follows a similar logic. In recent years the use of such approaches to track the performance of public investments in international agricultural research has been criticised because of their limited contribution to learning how to organise science for better impact (Horton and Mackay 2003; Hall et al., 2003).

Innovation capacity as a project outcome is even more problematic given the difficulty in setting up reliable counterfactuals that will allow a "with and without" type impact assessment. This is because innovation capacity in any particular location is very much a product of the history, starting conditions and evolution of those conditions over time. In other words it is a classic complex systems phenomenon and, as Ekboir (2003) and others have argued, it would be foolhardy to apply conventional impact assessment approaches.

The counterfactual approach seems to thus present three difficulties for measuring and proving the worth of innovation capacity development.

(i) The absence of a parallel universe: The capacity to bring about fodder innovation in, for instance, Ananthapur, Andhra Pradesh, India in July 2007, has unique characteristics that are related to this place and time and the history, starting conditions and evolution that go with it. Of course one could argue that you could compare the effectiveness of the innovation capacity developed in Ananthapur with a situation in a similar district in Andhra Pradesh. However, the people, the organisations, the administrative traditions and local politics — all key determinants of innovation capacity — would be different. If one was willing to ignore these differences, one could fool oneself into believing that this was a valid comparison. In reality, the only way to get a scientifically valid comparison based on the "with and without" logic is to compare the situation of Ananthapur in July 2007 in a parallel universe where there has been no intervention. As far as the authors are aware, economists have not yet mastered this parallel universe approach,

although one could imagine that fiendishly elaborate data intensive simulation modelling might start to address this.

(ii) The inappropriateness of comparative metaphors: Even if one chooses to ignore the parallel universe argument, unlike irrigation infrastructure (the classic metaphor for Gittinger's 'with and without' project appraisal approach) the ideas about building innovation capacity by strengthening links and networks will spread beyond the point of intervention. So, at best it will be "with" and "with-some". Similarly, if one takes the biological research counterfactual metaphor of a 'with fertiliser treatment' and control the case with building innovation capacity, the treatment is going to start off as a fairly weak chemical nitrogen fertiliser, increase in strength over time and then maybe switch to organic fertiliser when energy prices increase because of an unpredicted development in international politics. Obviously, this evolving treatments scenario presents all sorts of problems for measuring welfare outcomes of an approach that is based on the idea of nurturing institutional changes in a dynamic environment with strong local-to-global connections. Again, a sufficiently large sample size and sophisticated modelling approaches may be able to deal with this, but these lay beyond the reach of most of us.

(iii) Lagged outcomes from failure-based learning: Of course we are interested in tangible welfare outcomes of creating capacity and it would be nice to be able to conclusively measure these. However, because institutional change — and thus capacity development — can occur through failure of activities as well as successes, there can (and usually is) a long lag time before welfare outcomes become apparent. Take for example a project that tries to use participatory plant breeding to improve the nutritive value of crop residues fed to animals. The project produces excellent varieties that farmers and their animals like and which have high nutritive value. However, the technology does not spread because the scientists did not work closely enough with companies in the private sector-led seed delivery system. The welfare outcome of the initiative is limited, but the scientists have learnt to work in a different way — i.e., to include the private sector as well as farmers in their work. This has strengthened the capacity to innovate and will underpin future welfare impacts. This means that conventional approaches will either miss key outcomes as they will be institutional in nature or will at least grossly underestimate changes as these will only be viewed in short term tangible welfare terms. Is this amenable to mathematical modelling? Given enough time and data it is not inconceivable that this can be dealt with, but it is not a widely understood approach.

A Pragmatic Solution—Plausible Causal Connections

Rather than wasting huge amounts of time and resources in trying to construct an elaborate experimental design to test a counterfactual, a more pragmatic approach to assessing the impact of an innovation capacity approach is to devise a way of benchmarking this capacity and monitoring changes in it over time (a before and after comparison). This is really a question of tracking institutional change over time and relating this change to likely and actual welfare changes. We have typologies of desirable institutional changes. Socioeconomic benchmarking and the qualitative documentation of episodes of institutional and technical change and

consequent socioeconomic outcomes (episode analysis) would be a way of tackling this (This is discussed in further detail in Section III of this paper).

Such an approach, relying on multiple sources and types of information, can be used to build up plausible causal connections[19] between particular types of institutional change and the welfare impacts that are desired. Discussion with biometricians likens this to the way evidence on climate change has been amassed (pers. Com. Dr Richard Coe). There is no counterfactual for climate change (N=1!). Different pieces of evidence have been gathered over time to make the case. Let us just hope that it does not take so long to convince people that we need to be building innovation capacity rather than carry on transferring technology.

It is easy to understand the discomfort some may have with an approach that focuses on institutional change with welfare impacts lagged and mediated through long term and unpredictable patterns of capacity development. But when it comes to addressing fodder scarcity in a way that could helps poor people, what viable alternatives are there? Currently, very few!

[19] I am grateful to Ravi Prabhu for introducing me to this idea.

SECTION III: TOOLS FOR DIAGNOSIS AND INSTITUTIONAL CHANGE IN INNOVATION SYSTEMS

1. What the Tools and Methods must fulfil

The analytical insights into innovation capacity that is described in Section II of this paper frame two key activities in research to explore fodder innovation capacity. The first concerns diagnostic studies at both the micro level (the immediate networks and local contexts that the individual project initiatives will be embedded in, referred to as innovation clouds (see Section II) and the macro level, which would include the broad policy and institutional context in which project activities would be situated. Of course, a systems view of innovation capacity would suggest that this separation is artificial and unhelpful and that micro-level contexts always need to be thought of in the wider setting. It is nevertheless useful to highlight different elements of the contextual setting of innovation.

The second activity concerns facilitating and exploring institutional change. As discussed in Section II, institutional change is at the heart of the process of strengthening innovation capacity. Due to the location-specific nature of institutional arrangements these cannot be specified without reference to a particular context. So how then does one know what institutional arrangements are required in any given location? The solution we believe is to use a process-driven approach to derive them experimentally. This also serves as a way of investigating how institutional change can be achieved. The generic deliverables from this research will not be the specific institutional innovation developed as these may be very context specific (although some may be more generic). Rather, it will be the principles about how to stimulate institutional innovations that are locally relevant and relevant to policy goals such as poverty reduction or market development or environmental sustainability or a combination of these. Diagnostic studies might also reveal interesting institutional innovations and experimentation may focus on how these can be further developing and diffused more widely.

Another facet of the institutional changes that needs to be investigated is the project process itself, particularly how its approach — and changes to its approach — have consequences for innovation capacity outcomes. In other words, the project team and its actions can no longer be thought of as removed and separate from the institutional setting and network of players that the project is trying to influence and change in order to enhance fodder innovation capacity. The project team is part of the experiment and the process through which it implements the project

needs to be process-driven, scrutinised for conformity to systems concepts and analysed for lesson and principles. The ethnographical studies of international research and development organisations by David Lewis (Lewis et al. 1998) have shown that despite the rhetoric, the way these organisations deal with issues such as "partnership" tends to undermine the success of projects where often skewed relationships and opaque agendas inhibit information flows and institutional learning. This project needs to deal with this tendency and report on any institutional innovations it achieves in this regard.

A rider to all of this is that institutional changes and strengthened innovation capacities need to be sensitive and inclusive of needs and agendas of the livelihoods of livestock-dependant poor people. Here the word inclusive means that institutional change should not only include the agendas of poor people, but recognise that creating opportunities for the poor often involves innovations that help non-poor people — particularly innovations that strengthen enterprise development and create employment opportunities, or pro-poor services and products. As mentioned in the analytical framework in Section II, the value of institutional innovations to the agendas of the poor has to be rigorously assessed as part of the process-driven approach to facilitating and promoting (desirable) institutional change.

The way to do this is through socioeconomic benchmarking studies in the pilot innovation sites, with periodic re-surveys at appropriate points during the project. Such surveys would need to look at several things, including: the internal profile of the household (gender, education); household assets (land, livestock); sources of income; social capital ('networkyness' and reciprocity) and membership to peoples' organisations; features of livestock production, the livestock enterprise and/or livestock-related livelihood options; and "muddling through" strategies of the livestock enterprise (innovation capacity). Qualitative assessments — through episode analysis, for example — will also be useful, but a quantified benchmark study is required, supplemented by participatory assessments.

From an operational and analytical perspective this means that tools are needed to do the following tasks:

Task 1: Diagnosis of fodder innovation capacity to identify project starting points, including micro and macro elements

Task 2: Socioeconomic benchmarking, and follow-up studies

Task 3: Pilot innovation cloud process learning/ process-driven intervention correction

Task 4: Comparative analysis of institutional change processes

Task 5: Project team process learning

Task 6: Project evaluation

Some Cautionary Points on M&E

Before going on to review a number of tools to carry out these tasks it is useful to raise some cautionary points on M&E. These are raised because as a process-driven project M&E assumes

a special importance — it becomes a management tool for making mid-course correction and fine-tuning approaches by both the project team and by partners in pilot innovation clusters. However, as Biggs (2006) points out, while countless publications, guidelines and training programmes have been devoted to project M&E, the problems of getting M&E procedures implemented are well documented as well (Biggs and Smith, 2003). Biggs (2006) points to a recent World Bank publication on good practice, where it said, "M&E systems have been weak in World Bank Agricultural Knowledge & Information Systems and the AKIS programmes that they support" (Byerlee and Alex, 1998, p.v). This is in spite of the Bank being one of the primary promoters of project management and M&E manuals for over 30 years.

Part of the problem may be that the term M&E is often viewed as being synonymous with policing of project partners — and this is often the case. If M&E is to avoid becoming the Achilles Heel of this project, it is suggested that the language of M&E be dropped, and tools to achieve the institutional learning objectives of the project be selected — Learning-Based Management (LBM), perhaps. It is worth noting that many development projects have tackled this issue by making social learning the central activity around which all other things hang (see discussion of RAAKS below).

2. Review of Tools

RAAKS

Rapid Appraisal of Agricultural Knowledge System (RAAKS) was devised by Engel (1997) as a way of operationalising systems thinking on agricultural innovation. The methodology is set out in detail in Salmon and Engel (1999). The ideas underpinning it have much in common with the innovation systems concepts, with networking, learning and institutional change being given centrestage. RAAKS is described as a structured inquiry into the social organisation of innovation. Engel (1997) explains that it was designed as a participatory action research methodology to bring out social learning issues relevant to innovation and to design strategies for improving it in practical situations. The approach uses an elaborate and well thought out set of exercises and tools, which is described in detail in a manual titled "Networking for Innovation" (Salmon and Engel, 1996). The approach built on many years of field experience by Engel and his colleagues, particularly in the area of agricultural extension communication. The main elements of RAAKS are follows:

- Strategic diagnosis — an appraisal of constraints and opportunities leading to a joint definition of useful strategies
- Creative tension — contrasting findings produced by multiple analytical perspectives
- A task-orient path — leading participants from analysis and interpretation toward the design of potentially useful solutions

Whether it was ahead of its time, or whether it simply did not receive the attention it deserved, RAAKS is an approach that has not come into the mainstream in the 10 years since the manual was published. Those with experience of using it talk of its complexity. Indeed the manual sets

out, at times, a daunting set of exercises, steps and tools. The other feature of the approach is that it tends to focus mainly on activities in the rural domain, rather than looking at the wider set of actors that might be involved in an innovation system.

Despite these niggles, the focus of RAAKS on "complex innovation theatres and inter-organisational relationships" in rural settings is clearly of direct relevance to this project's investigation of institutional changes associated with strengthening fodder innovation capacity. It is recommended that the project use specific exercises and approaches from the RAAKS tool box appropriate to specific tasks. It is anticipated that these will be found particularly relevant to part of **Task 1** and **Task 2**.

Appreciative Enquiry/ Positive Deviance

In the words of Biggs (2006), "the idea of appreciative enquiry is simple: learn from the positive. This involves purposely seeking out and learning from past and contemporary political/ cultural situations where positive things have already occurred, and learning from the way different actors were effective in bringing about positive changes. The entry point for this analysis is finding situations where there is empirical evidence that positive changes have already taken place. This is a very different entry point from much mainstream poverty and social exclusion analysis where the preoccupation is either with (1) describing how bad a situation is (the problem), what the barriers and constraints are to change, and then suggesting solutions, or (2) learning mainly from earlier, planned development interventions. Learning from the positive does not discard learning from the outcomes of past planned interventions; however, it opens up the possibility of looking for different things in new places. Consequently, learning from the positive is a more inclusive approach than just learning from past development intervention success (or failure) studies. Not to be confused with "development success story" literature.

Guidance on the approach can be found in, for example, Hammond and Royal (1998). Examples (again from Biggs, 2006) of institutional innovations that have been identified by looking for unexpected outcomes include: changes in variety release policy to include farmer varieties; changes in R&D arrangements to allow farmer ideas to be used in research priorities and design; changes in national small-scale irrigation schemes to allow farmer technical innovation to be supported.

The business literature recognised a similar idea — positive deviance. For example, Sternin and Pascale's (2005) paper, "Your Company's Secret Change Agent", published in the *Harvard Business Review*. They argue that some business problems never seem to get fixed. Yet, they suggest that the tyranny of averages always conceals sparkling exceptions — isolated groups or individuals operating with the same constraints and resources as everybody else and who prevail against the odds. They argue that if these outliers can be identified, and what they do differently be understood and brought into wider use, then these (institutional) innovations can be used to great affect throughout the company. They recommend using the innovator as the 'evangelist' rather than trying to codify breakthroughs into "best practice". Ironically, Sternin and Pascale cite the sources of this great business insight not as IBM or Microsoft, but development projects dealing with malnutrition, AIDS and education. Their account of finding ways of helping Indian

sex workers get their client to practice safe sex using bananas and condoms guarantees that the reader will never forget either the concept of positive deviance or the meaning of the words 'institutional innovation'.

These ideas are very relevant to the fodder innovation project as they provide a way of identifying promising institutional innovations that happen unexpectedly and which the project can then further develop and diffuse to others. These 'positive deviants' might already exist in pilot learning clouds as a result of earlier interventions or on-going processes. They might also emerge as unexpected by-products of pilot innovation cloud activities themselves. It is recommended that these approaches are used in **Task 1, Task 2, Task 3** and **Task 5**.

Socioeconomic benchmarking

Socioeconomic benchmarking is a way of tracking change and continuously testing assumptions about the outcomes of different actions on households of differing wealth status. This helps identify unexpected outcomes and quantitative survey approaches can strengthen the voracity of lessons learnt from the project. This is the most useful tool for underpinning pro-poor claims of the institutional innovations developed by the projects. The questionnaire survey method can be customised to deal with the specific needs of the project outlined in the introduction of this section. It is recommended that this approach be used for **Task 2**. Combining such methods with participatory appraisals will be very powerful in building the plausible causal connections needed to demonstrate the way institutional change can lead to innovation that has positive welfare outcomes for specific social groups.

ILAC

Institutional Learning and Change (ILAC) refers to a cluster of tools that have been developed and adopted to promote the process of institutional change in international agricultural research centres (Watts et al, 2003). The idea is rooted in innovation systems ideas (Hall, et al, 2004). The success of the approach is far from well established. In all fairness, the ILAC initiative in the CGIAR has been useful as a discussion forum for these sorts of ideas and it has helped bring together relevant resources and briefing notes. It is probably best not to think of this as a single approach, but as a tool box of options.

Of particular relevance to this study are the institutional histories/ innovation histories idea (Shambu Prasad et al, 2007). This is a participatory approach to developing the history of a particular initiative over several years, identifying key institutional innovations that took place and investigating how these allowed programme objectives to be achieved. These histories also often reveal the institutional factors that stop programmes succeeding. One of the difficulties with them is that they unearth contested histories and political tensions between key actors. However, the trick with using them is to use the process of collecting information and discussing it with actors as a way of reconciling different positions, identifying blockages and finding ways forward. In other words, in the hands a skilled facilitator, this can be a useful tool in bringing

about institutional innovation.

This sort of approach clearly has relevance to this project, particularly its use for helping to reflect on progress and identifying ways forward. It may also be a useful way of exploring the starting conditions of pilot innovation clouds as these will inevitably have a history that will have implications for new interventions. It is recommended that this tool is used for **Task 1, Task 3** and **Task 5**.

Process documentation

The use of process documentation can be traced back to the development sector in the early to mid 1990s. It became increasingly apparent at that time that getting processes correct and then building the capacities for change that came with them was much more important than infrastructure development and other development project favourites (Mosse et. al., 1998). As the term suggests, the idea is that an organisation collects information on process. This might involve keeping project diaries or other ways to record activities and the decision-making process. As can be imagined such a broad information collection remit can be a very dangerous thing in untrained hands. Often information is collected that is so trivial that it offers little scope for analytical insights ("meeting decided to have tea at 2 p.m. rather than 3 p.m."). Alternatively, so much information is collected that its organisation and analysis into anything meaningful becomes unmanageable. The authors are not aware of any review of process documentation approaches that could guide of us in exploring institutional change, although the idea clearly resonated strongly with those of innovation systems.

It is recommended that the project not use process documentation unless it is to be carried out by a trained process documentation specialist who knows how to collect and analyse such information. Institutional histories and episode analysis and other forms of facilitated reflection and learning approaches make for a useful alternative — particularly in a developmental setting where partners are likely to be "doers" rather than "writers". However, institutional histories have a drawback in that it takes a significant period of time before useful lessons emerge from project — often years.

Innovation surveys

Innovation surveys are widely used in the industrial sector in developed countries. These are usually indicator-based and work well in situations where innovation is at the knowledge frontier and thus where measures of R&D activity are a good proxy for innovativeness. These methods, however, struggle to capture the systemic coherence dimension of innovation capacity. This approach is not suitable for exploring fodder innovation capacity where R&D activity will not be a particularly good proxy for innovation and where systemic coherence is likely to be the critical aspect of capacity.

Interaction matrices and typologies

The interactions between different actors and organisations are central to the functioning of effective innovation systems. To understand patterns of interaction, it is first important to map linkages in general ways, but then it is also necessary to understand the nature and purpose of these linkages. Two tools are useful here. The first is an actor linkage matrix which allows the extent of links to be systematically investigated. This is often more useful than a diagram with arrows as these can become too complex and unwieldy. In the actor linkage matrix, all relevant actors in the sector innovation system (identified above) are listed on both the first row and first column of the matrix. Each box in the matrix then represents the linkage between the two actors or organisations. It is important to be specific and mention a particular company, or specific farmer's organisation or research institute, rather than trying to map linkages between different categories. The example in Table 3 below shows that while there are extensive linkages, the sorts of linkages that support interactive learning and innovation are absent.

Table 3. Example of Actor Matrix

	Crop Research Institute	Vijay Mango Exports Pvt	Krishna Farmers Association	Krishna Market Commission Agents
Crop Research Institute		Knowledge services contract	Paternalistic	Nil
Vijay Mango Exports Pvt			Input supply links	Input supply links
Krishna Farmers Association				Output market links
Krishna Market Commission Agents				

Source: Hall et al, 2006

The second tool is a typology of linkages that includes both the type of link and the purpose of linkage (see table 4). This is important as it helps distinguish between the links an organisation might have with an input supplier (important though these are) and the links an organisation may have for the purposes of accessing a technology or collaborating on a joint project — which would clearly be more important for learning and innovation. This way of classifying linkages helps identify the sorts of linkages that might need to be developed to allow a continuous process of innovation to take place. Of the six types of linkage discussed, all may be important in an innovation system at different points in time. More important is to make sure that the right types of linkages exist in the right place. Paternalistic linkages will be of little value where interactive learning and problem solving are required. Successful innovation systems tend to have linkages that support interactive relationships.

It is also useful to classify linkages by the types of learning that they support. The innovation system recognises that learning can take a number of forms: learning by interacting, learning by doing, and learning by imitating (in order to master process or technology), learning by searching (for sources of information) and learning by training. Again, while all of these forms of learning are important, successful innovation systems are characterised by a high degree of interactive learning.

Table 4. A Typology of Partnerships and Learning

Types of Linkage	Purpose	Type of Learning
Partnership	Joint problem solving, learning and innovation, May involve a formal contract or memorandum of understanding. May be less formal, such as participatory research. Highly interactive. May involve two organisations or more. Focused objective-defined project	Mainly learning by interacting. Also learning by imitating and learning by searching
Paternalistic	Delivery of goods, services and knowledge to consumers with little regard to their preferences and agendas	Learning by training
Contract purchase of technology or knowledge services	Learning or problem solving by buying knowledge from elsewhere. Governed by a formal contract. Interactive according to client contractor relations. Usually bilateral arrangement. Highly focused objective defined by contract concerning access to goods and services	Learning by imitating and mastering. Might involve learning by training
Networks	Maybe informal or formal, but the main objective is to facilitate information flows. Provides know-how and early warning information of market, technology and policy changes. Also builds social capital, confidence and trust and creates preparedness for change, lowering barriers to forming new linkages. Board objective	Learning by interacting.
Advocacy linkages to policy process	Specific links through networks and sector association to inform and influence policy.	Interactive learning
Alliance	Collaboration in the marketing of products, sharing customer bases, sharing of marketing infrastructure. Usually governed by a memorandum of understanding. Can involve one or more organisations. Board collaborative objective.	Learning by doing
Linkages to supply and input and output markets	Mainly informal but also formal arrangements connecting organisations to raw materials, inputs and output markets. Includes access to credit and grants from national and international bodies. Narrow objective of access to goods.	Limited opportunities for learning. Some learning by interacting

Hall et al, 2006

3. The 'Four Element' Innovation Capacity Analysis Tool (aka The World Bank Methodology)

As far as the authors are aware the only published tool for undertaking diagnostic studies of agricultural innovation capacity is the Four Element Innovation Capacity Analysis Tool (aka The World Bank Methodology see Hall et al 2006). It was used in the World Bank study on Enabling Agricultural Innovation and is based on a conceptual framework and methods paper published as Hall et al (2006). Hall and his colleagues' explanation of the purpose of the tools and its intended users is as follows:

"A rapid methodology that could be used by a non-expert in combination with limited training and which would lead to the identification of plausible intervention points for national governments and development assistance agencies. The scope of this approach would not include a systemic survey of actors in the sector, although the guidelines and the checklists of questions set the parameters for the subsequent design of a survey instrument if this was found to be necessary."

It is called the 'Four Element' tool, as its four main analytical categories for understanding innovation capacity are:

A. Actors and the roles they play
B. Patterns of interaction between actors
C. Habits and practices (institutions)
D. The enabling policy environment

It also provides guidelines for undertaking a diagnostic assessment (Box 1). It gives a checklist of things to be investigated and an explanation of the framework for each analytical point. It also lists possible sources of information (the guidelines are provided in full in Table 4): The guidelines outline is as follows:

(i) Sector Timeline and Evolution

Central message or diagnosis from this section: What is the nature and dynamics of the sector? Who are the main players? What has been the performance of the sector till date? What challenges does the sector face? How effective have policies and support structures been in triggering innovation and developing a dynamic innovation capacity?

(ii) Sector Mapping

Central message and diagnosis from this section: Who are the main actors and organisations in the sector, what role do they play and what are their skills and competencies. Which actors and competencies are missing and is policy required to change the role of the public sector or to encourage others to play different roles or play existing roles more effectively. What is the extent of linkage between actors and organisations? What is the nature of these links and does it support interaction and learning? Which links are missing and what types of linkage need to be encouraged?

Box 1. A Checklist for Diagnostic Assessments of Agricultural Innovation Capacity

This checklist was developed as a diagnostic assessment tool for the World Bank (2006) study, Enhancing Agricultural Innovation: How to Move Beyond Strengthening Research Systems

1. Scope of actors and activities involved and the roles they play

- Is a sufficiently diverse set of organisations from the pubic and private sectors actively engaged in a sector considered in policy and intervention design — appropriate to the nature of the sector, the stage of development of the market and the institutional setting in a particular country.

2. Patterns of interaction

- Linkages, networks and partnerships between companies and between companies and research and policy organisations for knowledge-based interactions
- Degree of integration of poor stakeholders and mechanisms to promote their agendas
- Presence or absence of sector co-ordinating bodies and their effectiveness in particular institutional settings
- The presence or absence of stakeholder bodies such as farmers and industry associations, the scope of their activities, particularly knowledge-based activities such as research, training, technology acquisition and market and technology foresight. Institutional setting will also determine the effectiveness of such bodies

3. Habits and practices

- Habits and practices that enable or restrict collaboration between organisations
- Forms of behaviour that restrict change or which cause organisations to play the wrong role
- The existence and strength of social capital — patterns of trust and reciprocity — as foundations for evolving patterns of linkage across the innovation system
- Culture of innovation — demand for research in the private sector; an emphasis on problem solving rather than capacity building for future eventualities; limited use of collaborative arrangements for knowledge-based activities; an emphasis on both technological learning (mastering new technology) and institutional learning (mastery of processes for accessing and using knowledge more effectively)

4. Enabling environment — policies and infrastructure.

Source: World Bank 2006

(iii) Habits and Practices of Organisations

Central message and diagnosis from this section: What habits and practices do organisations have that restrict interacting, knowledge sharing, learning, investing and inclusiveness of the demand side? What types of habits and practices should be developed and in which organisations? Are there policies that are designed to support innovation but being negated by existing habits and practices? What measures could be put in place to account for this?

(iv) Wider Policy and Support Structures

Central message and diagnosis from this section: What is the set of policies put in place to encourage innovation? Which policies have a positive impact on the behaviour of actors and organisations and which do not? Are there contradictory policies that are counteracting each other? Are some of the policies that are not working being affected by habits, practices and institutions of actors and organisations and what additional measures or incentives would be needed to account for this? Similarly, are support structures effective, and if not, how do they need to be adapted?

The tool has been used on a number of occasions. It was used by local and international consultants in the original World Bank study to undertake case studies. Most of the case studies, while providing a good description of sectors and their evolution, had not initially analysed these with the framework provided in the tool. The cases did provide the right information but this had to be subsequently analysed by the lead consultant on the study and lead author of the guidelines. The two best written case studies (on Colombia and India) were by consultants who already had substantial experience with using the analytical framework over many years. In general, the cases (and, therefore, the tool) were weak in identifying differential social implications of particular innovation trajectories and institutional changes — although there were some useful examples.

The tool was used in 2005 by Rose Kiggundu to undertake a diagnostic survey of post-harvest and livestock innovation capacity in Uganda. Personal communication with Dr Kiggundu suggests that the approach would need to be modified for rapid appraisal techniques.

The tool has also been adopted by the DFID Research Into Use (RIU) programme to undertake diagnostic assessments in Sierra Leone (Clark), Rwanda (Barnet) and Bangladesh (Matsreat). Personal communication with Norman Clark revealed that after an intensive three-week study with two national professionals, he was able to produce a report that identified a strategy for interventions that would build innovation capacity.

To conclude, the World Bank methodology is one of the only tested approaches available for doing an agricultural innovation systems diagnostic assessment of capacity that is inclusive of everything from macro to micro elements of this capacity. It should form the cornerstone of the diagnostic assessments used by this research on fodder innovation capacity. However, it should be supplemented with tools that give sharper focus to the differential roles and impacts of the innovation process on both the poor and non-poor. Greater participation in the diagnostic

process by the organisation being assessed would help. It is most effective when used by researchers who have substantial experience of understanding innovation systems analysis. This last point hints at the fact that this form of assessment contains mainly tacit elements that are difficult to codify in guidelines. For this reason, the participatory and village level elements of diagnosis should take full advantage of the expertise of partners in pilot innovation clouds.

4. Concluding Points on Tools

Fodder scarcity is a problem for which innovation capacity presents a multidimensional approach to investigate. The central focus on institutional arrangements, institutional innovation and the innovation process is itself multidimensional and needs to be accompanied by socio-economic and technical appraisals. No one research tool fits this requirement. Fortunately, there already exists a whole 'raft' of tools that is used intelligently and can cover the information gathering needs of this project. This eclectic approach to tools and methods is important not just from an operational perspective, but also in terms of the contribution of the research to scholarship and learning in this area. Putting together this collection of existing tools and ideas in a new way to investigate fodder scarcity from a new perspective is an important innovation in its own right. Given the importance of the eclectic approach, the project should guard against getting bogged down in the dogma of any one particular method, using tools flexibly in ways that best achieve the project's analytical objectives.

Bearing this in mind, tools for dealing with the six analytical tasks outlined at the start of this section are summarised in Table 5.

5. Conclusion

This paper demonstrates that despite the fact that research-led technology transfer has largely failed to address the fodder scarcity issue, there is a wealth of empirical experiences that are pointing ways forward. One of these ways points to the need to revisit fodder scarcity as an issue of fodder innovation capacity scarcity. Understanding how to develop fodder innovation capacity requires an analytical framework that can explore the patterns of interaction that lead to innovation and institutional and policy settings that shape this process. The innovation systems framework can guide the exploration of these issues as it gives specific focus to institutional change. This, in turn, raises methodological questions about how institutional change can be tracked during an action research project, and how such a project is managed to deliver results that address both research and development objectives. These are the challenges.

Table 5. Tools for Dealing with the Analytical Tasks

	Timing	Focus	Tools	Execution	Outcome
Diagnosis of fodder innovation capacity to identify project starting points	As soon as partners are identified	Innovation clouds in partners' domain of intervention and the links to national bodies and the institutional and policy setting	Custom-built, drawing from 1. Four Element Innovation Capacity Analysis (World Bank methodology) 2. RAAKS 3. Appreciative enquiry/ positive deviance study	Joint study of project partners and innovation studies by technical specialists from the project team	An action plan in each pilot innovation cloud for addressing missing linkages, facilitating institutional change and/ or developing and promoting promising institutional innovations
Socio-economic benchmarking	As soon as partners, pilot sites and interventions have been identified. NB, be prepared to revisit interventions after baseline Revisited as necessary during the project to assess outcomes of particular courses of action Post-project for terminal evaluation	Households in pilot innovation clouds	Household socio-economic surveys and village level network analysis / social capital analysis	External team for objectivity	A reference resource to check assumptions about social and economic outcomes of institutional change

...Continued

Table 5. *Continued...*

Pilot innovation cloud process learning/ process-driven intervention correction	Regularly through the whole project cycle	Actions within both the project clouds as well as the wider policy and institutional environment	Custom-built process M&E system (not to be called M&E under any circumstances) drawing from RAAKS and other social-learning based approaches Actor Linkage matrix Technical appraisals and technical research reports Episode analysis Positive deviance facilitated reviews Advice and interaction for the Fodder Innovation Policy Working Group	Designed and implemented by project partners with technical assistance and with facilitation by specialists from the project team	Regularly updated action plans
Comparative analysis	Throughout the whole project cycle	Entire scope of project activities	Institutional development and innovation capacity benchmarking via a diagnostic study using World Bank methodology and tracking using custom-built indicators in each pilot innovation cloud Consultative capacity assessments (ISNAR-IDRC approach) Institutional/ innovation histories Case studies Supplemented with socio-economic surveys Ethnographic studies of project activities Policy process analysis	Specialist team members with expertise in institutional and innovation analysis Institutional change indicators jointly designed with project partners	Range of documented analysis, lessons and principles
Project team process learning	Regularly throughout the whole project cycle	The actions and strategies of the project team (security council)	Process documentation Episode analysis Positive deviance facilitated reviews Ethnographic analysis Other ILAC tools	All members of the project team facilitated by external resource persons with perception of project used as a key source of information.. A specialist process documentation member of the project team	Regularly updated work plans Range of documented analysis, lesson and principles
Project evaluation	Post project to draw lessons for future decisions projects and strategies	Entire scope of project activities	Formative and learning-based evaluation techniques	Everybody associated with the project, including the donors led by an external evaluation team	Lesson strategies and principles for everybody associated with the project

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