INCLUSIVE MARKET ORIENTED DEVELOPMENT (IMOD) AT ICRISAT

Background Document

ICRISAT
Science with a human face

International Crops Research Institute
for the Semi-Arid Tropics

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Acronyms

- ACE Agri commodity exchange: Lilongwe, Malawi
- ACH Auction Holding Commodity Exchange –Lilongwe, Malawi
- AGRA Alliance for a Green Revolution in Africa
- AIP Agri Innovation Platform
- BMFG Bill and Melinda Gates Foundation
- CoE Center of Excellence
- CFC Common Fund for Commodities
- CGIAR Consultative Group of International Agriculture Research
- CRPs CGIAR Research Programs
- DFID Department of International Development -UK
- ESA Eastern and Southern Africa
- FARA Forum for Agricultural Research in Africa
- GoI Government of India
- GSU Groundnut Seed Project
- HOPE Harnessing Opportunities for Productivity Enhancement
- ICAR Indian Council of Agriculture Research
- ICRISAT International Crops Research Institute for the Semi-Arid Tropics
- IMOD Inclusive market Oriented Development
- KVK KrishiVigyan Kendra (Agriculture Science Centers),India
- LIFDC Low Income Food Deficit Countries
- NASFAM National Small Holder Farmer's Association of Malawi
- SARI Selian Agricultural Research Institute, Tanzania
- SMU Sorghum Multipurpose Use
- SRF Strategic Results Framework
- TL2 Tropical Legumes
- WCA Western and Central Africa

Inclusive Market Oriented Development (IMOD) in ICRISAT

Background Document

1 Introduction: Why Inclusive Market Oriented Development (IMOD)?

1.1 What is IMOD?

IMODis the unifying conceptual framework for ICRISAT's work for the period 2011-2020. It emerged from the extensive global consultations, analyses and deliberations of the 2010 Strategic Planning process.In a nutshell, IMOD is a development model thatframes ICRISAT's strategy to help the poor to *harness markets while managing risks*, in order to most effectively reduce poverty, hunger, malnutrition and environmental degradation across the dryland tropics.

Many sub-dynamics are embedded within this nutshell description of course; they will be elaborated in subsequent sections of this backgrounder. It may be helpful first to put IMOD in its historical context.

1.2 How IMOD Originated

The CGIAR was established in the early 1970s at a time when mass famines were thought to be inevitable in the developing world. Food production was falling well short of the needs of rapidly increasing populations. So, increasing the production of staple food crops, particularly cereals, was the CGIAR's urgent first priority.

That effort helped to fulfill the promise of the Green Revolution in rice and wheat, which had begun a few years earlier. Production gains were so rapid that famine was averted. This was an enormous achievement.Yet, while the yields of those crops more than doubled, hundreds of millions of people still living beyond the reaches of that Revolution, in marginal farming areas such as the drylands,remained hungry and malnourished. We at ICRISAT had developed many Green Revolution-style varieties of drylandcrops, but their adoption

wasdisappointingly limited in many cases, particularly in Africa, because the favorable growing conditions needed to express the high yield potential of these varieties(water and fertilizer in particular) were unavailable and/or unaffordable for the large majority of poor.

Meanwhile, a major economic upheaval occurred during the 1990s across the developing world as a result of 'structural adjustment' and economic liberalization. Agriculture slipped to a lower priority on national agendas. Industrial and urban development became higher priorities. Many agricultural support programs and institutions were downsized or dismantled.

Marketing was deregulated, so more opportunities were opened to the private sector. But the private sector in general was less interested in poor smallholders. The private sector preferred the simplicity of sourcing its raw materials from big commercial growers. It needed to deal at large scales to minimize costs and maximize profits.

All these changes hit the poor hard. Smallholder farming families lost many of their supporting institutions and services during the 1990s. Marketing boards were dismantled; food prices were allowed to float, fluctuating wildly on the open market; and the costs of inputs soared due to the removal of subsidies. The poor were ill equipped to handle these dramatic changes, and they suffered.

As poor smallholders were abruptlyleft to fend for themselves, economists increasinglyrealizedthat the poor were now hungry not only becausenational cereal production was inadequate, but also because poor householdscouldn't afford to buy enough of the foods that they were unable to producethemselves. Structural adjustment had weakened the coupling between national self-sufficiency targets and the ability of poor families to achieve food security.

We in the CGIAR were struggling to adapt to these major structural changes as well. We strongly suspected that changes as dramatic as these would have consequences for our priorities and strategies, but we did not have a solid framework for understanding

oraddressing those changes. For example in reviewing the science agenda in 2001, the CGIAR's highest science body, the Technical Advisory Committee (TAC), concluded:

In order to address the stubborn persistence of poverty, particularly in the rural areas amidst rising global food supplies, the CGIAR has explicitly redirected its mission toward sustainable poverty reduction... However... not enough [is] known about the processes and conditions under which agricultural technology can be an effective instrument for poverty reduction... TAC considers that it is important to rigorously establish causal linkages...

CGIAR Research and Poverty Reduction - TAC Commentary, 2001

During the first decade of the new century, the CGIAR and many other institutions carried out investigations to try to clarify such causal linkages. But the next majormilestone in understanding came from beyond the CGIAR.

In 2008, the World Bank produced a comprehensive 386-page analysis of new trends in agriculture, the most authoritative study ever developed on this subject. The study was the 2008 World Development Report on 'Agriculture for Development.' This summary passage distills their new vision:

"The world of agriculture has dramatically changed since the 1982 World Development Report on agriculture. An emerging vision of agriculture for development redefines the roles of producers, the private sector and the state. Production is mainly by smallholders, who often remain the most efficient producers, in particular when supported by their organizations. The private sector drives the organization of value chains that bring the market to smallholders... The state... corrects market failures, regulates competition... and supports the greater inclusion of smallholders and rural workers. In this emerging vision, agriculture assumes a prominent role in the development agenda."

World Development Report 2008: Agriculture for Development (Overview)

Implementing this vision, the World Bank's Policy Objective number one in agriculture-for-development became, ***"Improve access to markets and establish efficient value chains."***

The World Bank study articulated, in compelling scope and detail, the "causal linkages" between agriculture and poverty reduction that the CGIAR's TAC had called for eight years earlier, and defined new roles for the major actors in development: the public and private sectors, and smallholders themselves.It argued that to become food-secure, these sectors would need to adjust their activities and working relationships in ways that helped smallholders toboth increasethe quantity *and* ***value*** of their production,improving both home-grown food production*and* incomes while managing the risks and vulnerabilities that these changes would induce.

We at ICRISAT were impressed with the World Bank's analysis, because its findings resonated with a wide range of experiences that we ourselves had encountered across the dryland tropics during the same post-structural-adjustment period. Time and again we saw, on the ground, poor people going hungry and malnourished despite ample food for sale in nearby village markets. Our farming system studies concurred with those elsewhere that had found that poor smallholders were buying much of their food, both because they could not grow enough to feed themselves year-round on their small parcels, and also because they needed to sell some of the meager quantities that they did produce, often at unfavorable prices, in order to meet urgent cash needs right after harvest. It was rare to observe truefood securityinpoor smallholder farm settings.

Something needed to change. Wetoo became convinced that to escape hunger and poverty in the drylands, smallholder farmers needed to have better connections to remunerative markets.While a foundation of subsistence food production remained necessary for the very poorest, they also needed ways to break out of the poverty trap that subsistence farming entailed if they were ever to achieve food and nutritional security.Our global consultations convinced us that this theme was prominent in all our regions, and thus was ideally suited to become a unifyingparadigm for our new institutional Strategy. We called it IMOD, for Inclusive Market-Oriented Development.

IMOD was a challenging yet exciting new development model, because it required us to re-think many of our priorities and activities. It was a major change from business-as-usual. Our previous focus had been mainly on commodity production agriculture, but now we were

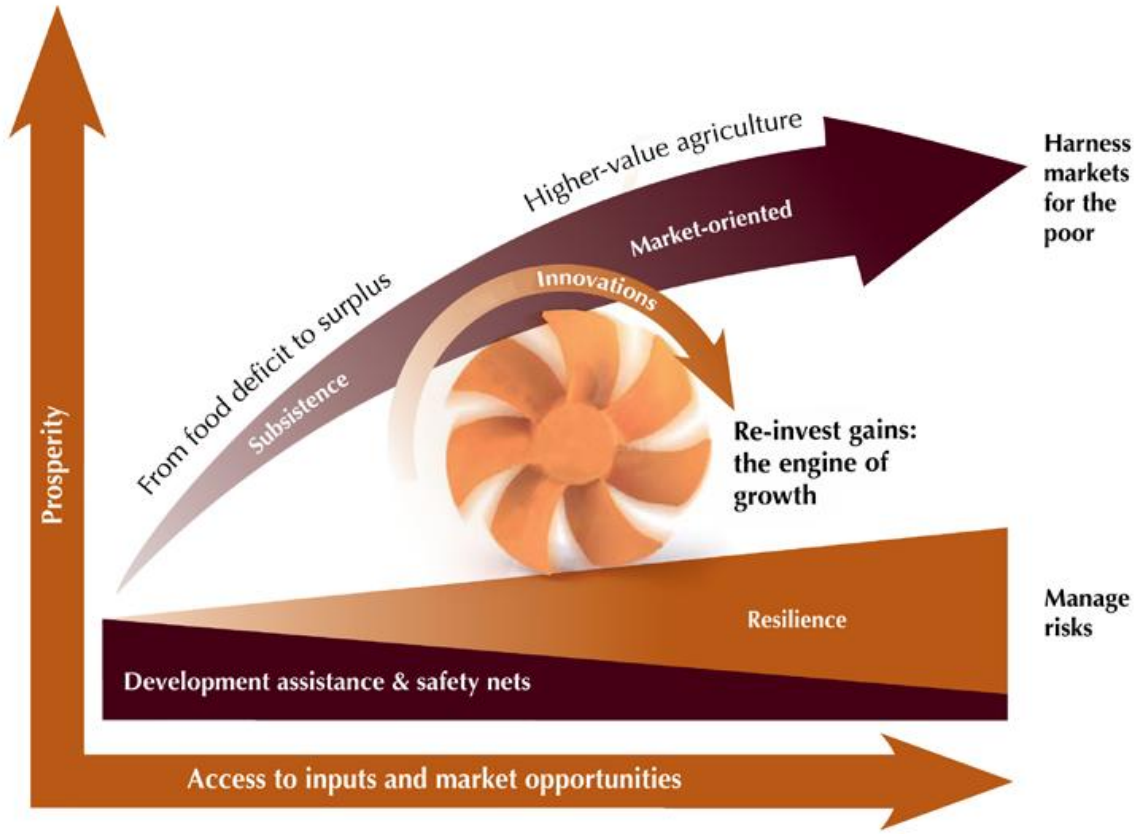
embracing a more dynamic and holistic development perspective centered on the well-being of poor smallholders. Improving their well-being would require interventions beyond just the production operation, in sectors such as inputs, processing, markets, and consumption as well. New partners and types of partnerships would be required.Beyond just raising yields *per se*, nowwe and our partners would need to devise a range of strategic interventions that could enable farmers to progress along the market-oriented development curve. We realized that managing risks along this curve would be a major issue, since poor farmers lack the resources to fall back upon if and when their market-oriented ventures failed.

This brief birds-eye view of IMOD and its origin sets the context fordescribing its features in more detail, below.

1.3 The Main Elements of IMOD

We realized from the beginning that even though IMOD is a major change in our thinking and strategy, we would need simple ways to explain it to the world in order to gain understanding, support and partnership for its effective application. We devised the diagram below to visualize IMOD's main elements as simply as possible.

Inclusive Market-Oriented Development (IMOD)



There are two main components of IMOD, as described earlier: harnessing markets for the poor (pictured as the curved 'arrow of change') and managing risks (the two layered triangles below). Between them is a wheel meant to represent the engine of growth: increased income that is reinvested into both of these main components. This reinvestment creates a dynamic that moves poor farmers from the left side of the diagram – impoverished subsistence farming – towards the right side of the diagram, which is prosperous market-oriented farming.

Elaborating on these main elements in turn:**harnessing markets specifically to benefit the poor**, carrying them along a development pathway from subsistence to market orientation, implies that value chains must be approached in a very different way than the conventional approach. The conventional approach requires large scale, large investment, and simplification of all processes for maximum efficiency. These characteristics are roughly opposite of what the poor can offer, unless major innovations appropriate to their capacities are devised. This is why IMOD is a major change from business-as-usual.Innovations are required that help the poor gain economies of scale, work collectively for greater market coordination and clout, achieve innovative financing, increase technology and information flows and application,among other challenges. Innovations must also be dynamic rather than static: they must enable and incentivize the poor to move from left to right along the

development curve, rather than the old model of static innovations that may solve narrow technical problemsyet still leave the poor, poor because they are divorced from a development strategy(thisimportant point is discussed in more detail later).

The "**engine of growth**" (spinning wheel in the diagram) highlights that innovations such as those described above are the engine that enables system change. Success in connecting to markets must generate an economic surplus so that the poor can improve their quality of life, and also to enable increasedre-investments to better harness markets and to better manage risks. In summary, the economic surplus generated by innovation, when re-invested wisely, is the engine that drives development from left to right in the IMOD diagram.

The third major element of IMOD, the bottom 'platform' in the diagram, is **managing the risks that poor people face.**Risks are especially high for smallholders, because they have few resources to fall back on if something goes wrong. IMOD perceives two major dynamics in risk management (each with many sub-dynamics). For the very poorest farmers (left side of the diagram), risk management requires outside help through development assistance and safety nets such as subsidies, emergency food reserves, NGO aid and relatedinterventions. As incomes increase through IMOD,smallholders increasingly re-invest in building their capacities to withstand and rebound from shocks by increasing various forms of capital (social, human, financial, institutional, environmental and others), becoming more and more**resilient**.

To complete this brief exposition we address a few of the most commonly asked questions about IMOD.

1.4 How does IMOD differ from a Value Chain approach?

Our short answer is, the "I". **IMOD's explicit goal is to *include* the poor** in value chains.Conventional value chain innovations tend to deliver more benefits to the non-poor.Many principles of conventional value chain strategy must be turned on their head if these chains are to become inclusive of the poor. As just one example, the conventional approach of reducing the number of actors in the chain to make value chains more simple and efficient,can through imaginative interventions be replaced by chains that include and coordinate as many poor as possible by putting to good usethe diversity and rich knowledge base that this brings into the chain.major innovation and is a distinguishing

1.5 What does it mean to say that IMOD is a *Dynamic* Development Pathway?

What does 'dynamic' vs 'static' mean in ICRISAT and partners' R4D context? Before IMOD, we segmented farmers into different categories, such as very poor subsistence farmers, versus progressive farmers. We then assessed their priority problems and attempted to solve them, and provide the solution to the relevant category of farmer. The system was 'static.' Poor farmers were a little better off with that problem solved, but they still remained poor. We

didn't pay much attention to helping farmers **achieve the major change** from the subsistence category to the more prosperous category.

IMOD changed this static thinking. IMOD is a process of ***movement along a development pathway*** from impoverished subsistence farming, to prosperous market-oriented farming. This movement is what we mean by the word 'dynamic'. The dynamic imperative of IMOD forced us to seek different kinds of innovations - those that would ***move*** farmers from poverty to prosperity. With IMOD, we began to envision a much larger and more exciting degree of change – not just *alleviation* of poverty, but *escape from* poverty. A wider range of options could be explored, for example going beyond just low-value commodity crops to also address high-value specialty crops.

How and why does IMOD change the nature of ICRISAT partnerships?

Including the poor also requires new kinds of partnerships. Value chains involve actors in the input supply, output processing, distribution, marketing, financing and other spheres that are non-traditional for ICRISAT and its R4D institutional partners. By joining forces with these new kinds of action-oriented partners, major impact can be leveraged in a relatively short time. Our engagement with several legume value chains bears testimony to this potential, e.g. the groundnut value chain in Malawi, the pigeonpea value chain in Tanzania, and the chickpea value chain in India.

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The preceding basic outline of the elements of IMOD leads logically to the next question: How it is usefully applied in the real world? This is the focus of the next section.

IMOD Application in Practice

Like most models, the test of IMOD's value and utility is as a practical framework for posing R4D questions and testing hypotheses and thereby gaining new knowledge about how to improve ICRISAT and partners' effectiveness and impact. In other words, the application of IMOD to real-world situations is not a discrete short-term activity with beginning and end. It is an iterative process of applying the model, learning from experiences in applying the model, and applying that further learning to improve the application further. IMOD is an iterative learning tool, rather than a cookbook formula on how to precisely do development in every situation and every location.

We believe that IMOD guides us to ask more relevant questions and find better and more relevant answers to development challenges in today's dryland tropics. In contrast, if we had

instead continued to doggedly pursue the classic Green Revolution model (e.g. breeding for high-input yield potential maximization - see Introduction), our experience tells us that the result would be farless relevance and impact. This is why a frame of thinking is so important and why we put such major effort into the 2011-2020 Strategic Plan.

Ultimately, though the proof of the pudding is in it's taste. Has IMOD increased ICRISAT's R4D effectiveness? We believe that it has indeed generated significant benefits. IMOD has consolidated and sharpened our thinking about how development occurs. IMOD has prompted questions that might otherwise have been overlooked, resulting in disappointments. Questions such as:

- IMOD is often knowledge-intensive and system-specific, so how can it be scaled up for widespread impact?
- How do we measure the pro-poor economic performance of an IMOD system, particularly *ex-ante*? How can we predict whether we are likely to succeed in eliminating poverty? Food insecurity? Managing risk?
- To what extent can the impoverishing limitation of small farm size effectively be overcome by increasing the value of farm outputs per unit land area and per unit time?
- How do we adapt IMOD to different cultural and policy settings? A profit model that works in one country may be unworkable in another, or may encounter cultural resistance.
- How do we effectively measure gains in farmer resilience? In livelihood capital? In food and nutritional security?
- How do we and our partners achieve collective action among thousands of poor and illiterate subsistence farmers in order to help them become market-competitive?
- What are the features of potential innovations that are most likely to contribute to dynamic development, i.e. that enable and incentivize farmers to reinvest further in IMOD to further improve their quality of life?
- How do we protect farmers from the risk of boom-and-bust cycles (market saturation) for specialty crops?
- How do we engage international export demand and partnerships to provide greater market size and stronger market pull?

- What comparative advantages of smallholders can we identify that can be utilized to overcome some of the big challenges in connecting so many diverse players to markets in a unified, high-value manner?

Many additional issues could be raised, and are indeed being raised as new learning prompts new questions.

With that perspective – of IMOD as a learning tool - in mind, below we describe a number of our most signficant learning cases and outcomes to date that involved the application of IMOD.

2 ExemplarCase Studies of IMOD approaches and implementation in ICRISAT

As mentioned,ICRISATis probably the first CGIAR center to make "smallholder farmer inclusiveness and value generationthrough market linkagesit's core strategy. While it is envisaged that this approach isinternalized in all activities it also envisages the key role ourpartners will play in scaling out these activities to impact the lives of millions of smallholder farmers in SAT.

The IMOD approach has been demonstrated in various activities within ICRISAT,some of which are briefly described below: Some of these have commenced before 2010 which also indicates ICRISAT's continuing systems approach: Three exemplars have been highlighted in detail followed by a few more case briefs.*(Additional case briefs are presented in Annexure2).*

2.1 Exemplar Case Study – 1

Cluster-based approach targeting women farmers to enhance the groundnut value chain in the Dosso region in Niger

The Smallholder women farmers in the Dosso region of Niger have traditionally been excluded in the market linked activities of the ground nut production cycle.

Through projects like, the Groundnut Seed Project supported by CFC and TL-II supported by BMGF, ICRISAT and its partners have successfully built up community-based groundnut seed systems involving women in the Dossoregion, Niger. Individual farmers and women's groups have been trained or strengthened in seed production, trained in small-scale business skills and marketing and are now producing good quality seed. Farmers with access to this good quality seed are now producing good quality grain. These interventions have been relatively successful in the production sub-sector, but the processing and marketing sub-sectors were the traditional weaknesses in the groundnut value chain.The Strengths, weaknesses, opportunities and threats have been analyzed to show that the major upgrading options include

(1) the consistent supply of high quality grains to processors, (2) the lack of proper equipment to process groundnut into oil, cakes or pastes, (3) the lack of training in business and marketing skills, (4) the lack of access to credit for working capital or trade, and (5) the poor linkages to traders who can sell the products on. Therefore, a pilot economic experiment was set up as a proof of concept for enhancing the groundnut value chain. Five clusters were formed in the Dosso region, each with about 600 women processors. The cluster-based approach has the advantage of helping farmers/processors pool the demand for raw material and to sell the processed products in an aggregated manner there by improving their bargaining power. The villages involved are MoussaDey, GuidanGaba, Sambera and Gaya, which were selected on the basis of the large volume of groundnut oil, cakes and pastes processed. Five other villages were selected as control sites with similar socio-economic characteristics as the project villages but groundnut is processed by hand in the control villages.

Resolving the poor access by processors to high quality grains

ICRISAT networked a meeting of producers of grains and women processors in the Gaya region to ensure a consistent supply of at least 1,800 tons of seed to processors (with a potential of 6,240 tons of shelled groundnut translated in a potential of 1,872,000 liters of groundnut oil per year) and thereby reduce price variability. Formal contracts were established in each cluster between the two parties. Contractual attributes include the type of variety, the mode of payment (cash or credit), the price formulated at 20% above the on-going market rate at the time of purchase and the quality of the raw material (less than 2% physical impurities). These contractual arrangements are currently being monitored for compliance and difficulties in meeting the contracts. However, to facilitate such contractual arrangements, access to credit became important.

Also now these women clusters are growing ICRISAT varieties of groundnut –G-11, RRB, 55437 and sell surplus seed to other farmers/NGos, and seed companies introduced by ICRISAT. On an average they got 20-30% higher than the market price of the commodity.

Seed is stored in covered godowns (pallets, tarpaulins, PP bags etc) and they have been trained on aspects of controlling aflatoxin and other pests/termites.

Improving access to credit for processors

Accessing credit has always been a challenge for smallholder farmers and processors. In general, credit is not readily available and when accessible it is of relatively low volume and costly. The repayment periods do not match with producers' cash flow and producers incur high transaction costs in fulfilling monthly payments due to the long distance traveled to the credit center. This was the experience with financial institutions like AssuDendi (eg $2600 @12% for 5 months)

The Project has established contacts with the Agricultural Bank (BAGRI) and a rural project is ready to provide a guaranteed line of credit to BAGRI at the level of US$ 100,000. This will allow farmers to access working capital at cheaper prices and at the required volume to purchase raw materials and equipment.

Improving access to processing equipment

A need assessment on equipment showed that the lack of huskers and processing machines were the major constraints. On an experimental basis, the TL2 Project supplied two mechanical decorticators and two small-scale oil processing machines in each of the five clusters. An ex-ante profitability analysis of equipment showed a high return to using

decorticators as well as the processing machines. Decorticators helped processors save onan average 2.7 minutes of time per kg of groundnut dehusked and reduced costs by 2.5 FCFA per kg. In addition, the use of processing and, especially, milling equipment reduces time by 0.75 minutes and costs by 6.25 FCFA per kg. For oil extraction, processors gained an average 5.5 minutes and 18.75 FCFA per kg of shelled groundnut processed.

The use of both decorticators and oil processing machines by processors contributes to reducing labor time by 22.2 minutes and costs by 27.5 FCFA/kg of groundnut shelled. Equipment is being monitored as to its replacement by the women processors.

Marketing of groundnut oil, cakes and paste

There are no assured markets for processors of groundnuts in the Dosso region for whom gaining access to markets for groundnut products remained a major challenge.
Processors sell four main types of processed products, subdivided to include groundnut oil, paste, cakes, KuliKuli, Digadigué and roasted nuts. All processors target their local market by selling to traders who supply the urban markets.Often, because of lack of coordination between processors or of collective action, the processors would sell the products as individuals and were unable effectively to negotiate withtraders. This contributed to a low volume of processing and subsequent sales of groundnut products. This low level of activity gives traders cause to complain of poor quality and volumes of the produce.

To resolve the poor access to markets, the project liaised with two large traders in urban Niamey who each expressed interest in buying 5,000 liters of groundnut oil per week. This translates into a demand for grain (raw material) of about 1,800 tons of shelled groundnuts per year. This enabled the better processing and aggregation of volumes for the women clusters and a better supply chain for the larger traders.

Management teams at cluster level

Sustainability of such interventions is assured with appropriate capacity building.A management team in each cluster, including the President of the women's association, the treasurer and the auditor is formed and trained in small-scale business and management skills. In addition, in each cluster, a man and a woman were trained in using the decorticator and processing equipment and making small running repairs. Technical back-up in in using processing equipment was provided during 2011/12 by a partner CDMA, a processing equipment supplier.

As a result the incomes and livelihoods of more than 6000 women farmers have been transformed. ICRISAT has played the key role in enhancing productivity with improved varieties and also supporting on the value addition through seed, processing for oil and market networking and capacity building.

The group is now considering to sell GN oil in branded small containers .This model is now being looked for scale up by other farmers in other regions through a lot of farmer visits to Dosso and willingness to make their own investments in both farming with better varieties and processing for accessing the value chain .

2.2 Exemplar Case study 2

IMOD attributed intervention for enhancing adoption of improved chickpea cultivars in Andhra Pradesh state of India and Myanmar

Andhra Pradesh state of India and dry central zone of Myanmar have similar growing environment for chickpea. Farmers were doing subsistence farming of Chickpea and the crop season was short because of mild and short winter season and exposure of crop to terminal drought and heat stresses. The identification and development of early maturing varieties with fusarium wilt resistance and high yield potential was identified as a potential alternative, provided the benefits were evident and the seed was available at a competitive cost.

ICRISAT developed early maturing, fusarium wilt resistant and high yielding breeding lines of both desi and kabuli chickpea and supplied these to research partners in India and Myanmar. The partners evaluated these lines for local adaptation and released several varieties. Farmers' awareness about improved cultivars and production technologies was enhanced by various awareness activities, including field days, farmer's fairs, print and electronic media, training programs, and conducting on-farm demonstrations and participatory varietal selection trials. The seed availability was enhanced by strengthening both formal and informal seed systems and making available small seed samples to farmers.

The impact of the intervention

Andhra Pradesh: There has been a rapid and high adoption of improved ICRISAT chickpea varieties, JG 11, KAK 2, JAKI 9218, Vihar in Andhra Pradesh during the recent years. These varieties now cover over 80% of the chickpea area in Andhra Pradesh showing a 7 fold increase in productivity and 3 fold increase in area. Andhra Pradesh once considered a low productive state for chickpea due to warm and short-season environments now has the highest yield levels in India.

There has been a transformation from subsistence to market-oriented cultivation for chickpea in Andhra Pradesh, which shows a combination of science and markets were the drivers of large scale adoption and.

Myanmar: Likewise the improved ICRISAT chickpea varieties Yezin 3, Yezin 4 Yezin 6 and Yezin 8 were rapidly adopted in Mynamar and now cover about 85% of the chickpea area during 2011. It has grown almost 5 times to 400,000 mts in the past few years and area increased by 2.5 times to 319,000 ha with a 2-fold increase in the productivity (712 kg to 1369 kg ha). More than 50% of the chickpea area in Myanmar is under kabuli type chickpea which fetches a higher price than the desi chickpea in Global markets. Annual exports are about 50,000 tons and chickpea is currently a commercial crop in Myanmar and has helped smallholder farmers in linking to market and enhancing income.

The chickpea success stories from Andhra Pradesh and Myanmar indicate that the adoption of improved cultivars along with matching integrated crop management practices is needed for chickpea production and combined with markets has resulted in transforming lives of small holder farmers in AP and Myanmar. The lessons learned from the chickpea success stories from Andhra Pradesh and Myanmar can be used for enhancing chickpea production and farmers' income in other chickpea growing areas. Multistakeholder partners and Partnershipswill remain the key.

2.3 Exemplar Case Study 3

Promoting Rural Seed Business Entrepreneurs :ICRISAT's- Agri-Innovation Platform.

Good quality seed of improved varieties can significantly improve crop productivity leading to increased availability of crops in Semi-Arid Tropics. Presently smallholder farmers lacking access to quality foundation as well as breeder seeds have to depend on government agencies and agricultural universities for their seed requirements. The quality and integrity of the seed bought in local markets is most often uncertain and inferior resulting in low productivity of legumes.

The strategies devised by the government agencies in the past to address these small holder farmers challenges need to be upgraded.Hence there is an opportunity to promote rural entrepreneurs, which involves the farmers in quality seed production and marketing.

The sustainability of rain-fed legumes cultivation is heavily dependent on the availability of seed of locally adapted, farmer-preferred varieties at the right time in required quantities and at the right price to meet the demand of resource poor farmers. A novel approach on seed business incubation (SBI) was identified by the Agribusiness and Innovation Platform (AIP), ICRISAT in order to address the issue. This is achieved by promoting rural entrepreneurs & Community Based Organizations (CBOs) as seed ventures in seed production system at the village level. This model can effectively incubate and nurture large number of rural entrepreneurs and benefit more number of farmers by commercialization of new seed varieties. Besides accessing locally acceptable varieties and cultivars, it can associate with regional institutions for effective implementation of the model.

Seed business incubation is built on the promise of rural entrepreneurship to promote and address the basic demand and supply gap of quality and new varieties of seeds for the farmers. A set of rural entrepreneurs were selected from the states of Andhra Pradesh (AP) (four Rayalseema districts) and Tamil Nadu (TN) (Madurai and Nagai district) in India. These entrepreneurs were trained on seed production, business management and marketing of seeds. Seed processing facility was established in two locations in Andhra Pradesh and Tamil Nadu for giving access to the seed entrepreneur in a timely manner. A quality control team was formed comprising of scientists and seed experts who visit these farms and assures support for quality seed production.

The seeds are processed in the common processing facility and packaged under the brand names of Mana Seeds in AP and Aharam Seeds in TN. These brands are owned by the project partners named Aakruthi Agricultural Associates of India and KazhiKadaimadai Farmers Federation, respectively. The seed certification process is facilitated through the respective state certification agencies and the marketing of the seed is done through institutional tie-ups with National Seed Corporation (NSC) and Andhra Pradesh State Seed Development Corporation (APSSDC).

This initiative has already benefited multiple stakeholders through sustainable rural entrepreneurship, quality seeds at village level and the commercialization of seed. The impact of the intervention across crops was--over 16,500 quintals of Ground nut, Chickpea, Pigeonpea and paddy were supplied to over 9700 beneficiaries. All ICRISAT varieties were well accepted by the farmers which enhanced their yields.

The Seed Business Incubation program of AIP - ICRISAT has been established as a successful model and is presently being replicated in the other districts of AP and TN. A large number of rural entrepreneurs from states like Maharashtra, Madhya Pradesh and Karnataka have also evinced interest in becoming a member of this program. A number of donor agencies have also shown interest in adopting and scaling up this successful model in other parts of the country. From the current strength of 180 entrepreneurs, it is proposed to increase it to 500 entrepreneurs in the near future

2.4 Other ICRISAT IMOD Caselets/briefs

- **Microdosing, commodity warrantage / warehouse receipts and small seed packs in Africa**.

  Small & Focused fertilizer application in nutrient deficient fields can increase yields of sorghum and millets from 44% to 120%.In West Africa some 25,000 farmers have adopted this technique. Eventually crop surpluses stored under inventory warrantee will enable farmers to sell at higher prices at a later date.Just as micro quantities of fertilizers are more accessible to the poor , so are small sized packets of improved seed; these are much in demand by the poor and especially by women for their home gardens and field crops, which in turn impact the nutrition of the families.Hundreds of farmer groups are currently testing/adopting this. In a regional project by AGRA they are targeting 400,000 households by 2013/14.

- **Bhoochetana and watershed approach for dryland farmers in India,China, Vietnam, Thailand**

  In collaboration with State Governments and local agencies,ICRISAT is now helping more than 6 million dry land farmer families to boost yields by 30%to 50% by overcoming micro nutrient deficiencies through targeted fertilizer applications and soil and water management interventions. In the Karnataka state in India, the economic impact in 2011 monsoon season

itself, was UsS$130 million, returning $14 for every 1$ invested in the state. In Asia, net crop income doubled. On an average cow milk yield has risen from 1.5 liters to 4.0 liters.Similar impacts were witnessed in the watershed interventions in China and Vietnam and are now being scaled out to the Philippines as well.

- **Revitalizing the Value Chain for rainy season sorghum,India**

  Sorghum is used for cattle and poultry feed and, processed foods and alcohol. Discussions with partners in the IMOD value chain helped identify major gaps in grading, linkages to credit and inputs marketing outlets. The solutions were the creation of farmer groups for effective aggregation of input supplies and credit, breeding and dissemination of better quality cultivars, training farmers in Integrated crop management, improved on farm grain storage --all of which together increased grain and fodder yield by 25% to 50% and incomes more than doubled from $162/ha to $365/ha.

- **Groundnut in Ananthapur,India**

  ICRISAT variety ICGV9114 increased pod yield by 23% resulting in a 35% increase in incomes reflecting $110/- per household. Seed production through farmer associations has occupied over 3% of the sown area contributing an additional 42,000 mts valued at $3.7 million to 30,000 households. Assuming a 35% adoption by 2020 these benefits will raise to $500 million per annum. Also, as a corollary, ILRI has advised on improvement of livestock milk yields by 11% after the use of ICGV 91114 haulms (vegetative bio-mass) fodder and enhancing farmer incomes further.

- **Pigeonpea development in Northern Tanzania**

  In Northern Tanzania Pigeonpea has been traditionally grown at a household level. With the introduction of Fusarium wilt resistant seasonally adapted export quality grains, these have now been adopted in 45% of the crops area (doubled in the last 5 years) resulting in an additional 1.3 t/ha or 33,000 additional tons and an additional $33 million to the farming community. Growing Indian consumption continues to drive Pigeonpea global markets and is the key import destination.

- **Innovation Platforms for Goat and Fodder in Zimbabwe**.

ICRISAT anchored the creation ofpro-smallholder farmer Innovation Platforms with a cross section of stakeholders and identified the formation of small holder friendly and transparent auctions for small livestock.These platforms also identified dry season fodder (bana grass andmucuna) and negotiated prices with agro dealers, greatly reducing costs and goat mortality and preserving farmer incomes in the traditional dry seasons.

- **Agri-business Innovation platform- India and Africa**

ICRISATs' Agribusiness and Innovation Platform (AIP) is a public–Private partnership model that fosters innovative agri-enterprise to bring R4D innovations of ICRISAT and partners to the marketplace for IMOD impact. It has supported more than 100 joint ventures and attracted $5 million over the past 4 years. In itsNutriPlus initiative, it incubates partners that develop, test and market, innovative processed food products from staple grains and legumes that can increase incomes from smallholders. In 2011 ICRISAT launched a South–South Initiative for Indian–African Partnerships in Agriculture Research for Development and with collaborations with FARA and the mentoring of 6 Agri-business and innovation consortia in 5 African countries.

- **ICT and Agriculture in India to be scaled into Africa**

Innovative use of ICT to disseminate knowledge and best practices to smallholder farmers through various low cost web and mobile phone customized applications, in conjunction with partners. An agriculture knowledge management platform was conceptualized with NAREs in India with agro advisories to over 20,000 farmers across 20 locations. Initiatives like Krishi Vani and KrishiGyanSagar are gaining popularity with the farming community.

- **Emerging IMOD intervention 2012-13–Pigeonpea in Rajasthan:**

More recently,ICRISAT in collaboration with the Agriculture Research Station, and NAREs, in Jaipur released eco-friendly Pigeon Pea varieties, to small holder farmers in 4 dry land districts of Rajasthan. In a short span of 2 seasons there has been a growing acceptance of market linked production where farmers are not only consuming for themselves for the protein but are value adding with small scale milling for direct sale to the markets.

Furthermore the leaves, pods and broken seed are used as fodder and the stalks are used for firewood which has reduced the drudgery of the women. Incomes have more than doubled across seasons.

"Through ICRISAT's help and expertise we have increased the technology commercialization from India from 40 agro technologies in 2010 -11 to 93 in 2012-13. We have also enhanced the number of start-up clients from 60 to more than 600across 2012. This has bought in revenues above $2 million through 10 business planning units.

– Dr PS Pandey, National coordinator, Indian Council of Agriculture Research.

3 Initial Successes, Common Threads and Key Lessons

The experience of the past three years has given insights on what are the initial drivers for the early impacts of IMOD. Markets have played a critical role and are a strategic entry point for IMOD interventions and so are the reverse value chains linking relevant inputs like seed, fertilizer etc to small holder farmers.

Role of Markets:In Sub Saharan Africa, overall markets are not as evolved as the Government supported systems and the more organized private sector in South Asia, though inefficiencies and gaps still exist. However there is enough evidence to show that markets are increasingly driving production of agricultural commodities. Some good examples as we have seen have been in the Groundnut production in Malawi, Pigeon pea and sorghum in Tanzania, Millet and GN in Niger, Chickpea in Ethiopia to name a few. There is nowa growing imperative among some of ICRISAT's key development partners on value chains and are supporting better market linked production for e.g. sorghum for the malting industry (Serengeti Distilleries, Tanzania Breweries etc.). ICRISAT and its partners are working closely with these Farmer groups and capacity building them on standards for linking with this value added processors. The situation in SSA is still evolving with emerging models of some Public sector investments but a growing private sector role in agriculture. Innovative models will have the opportunityto develop good farmer linkages and capture market share.

3.1 Role of Partnerships: Common Purpose

To achieve scale and impact it is critical that ICRISAT's partners and stakeholders have similar and aligned objectives. This market driven inclusive and systems approach is getting internalized/re-enforced with many of ICRISAT's partners in NAREs, Development sector, NGOs and Private Sector. Workshops and training programs help in developing common thinking which is also reflected while discussing and developing work plans with partners (more details of some Partners in Annexures 3).

> It is imperative to link high science to small farmer holders and to enhance productivity and food security at the Household level. We need to look at markets first and then look at farmers.
> An ICRISAT partner

3.2 Key Lessons Learnt:

a) **Systems approach:** Focus on farmer incomes has helped look at the full value chain and keeping markets in mind. This has called for a deeper engagement, with a holistic approach and looks at all the key players along the value chain.

b) **Stakeholder Engagement**: This has been critical to the scaling out of IMOD. Be it science partners like ICAR, KARI, ANGRAU, INRAN or farmer organizations like NASFAM or development partners like Africa Harvest, EPFC, and private sector breweries , have worked in close coordination to give a "win-win ' situation to each, as distinct but linked players on the value chain.

c) **Farmer adoption & enthusiasm:** The smallholder farmers have been enthused with these new systems (value chain) approaches and have adopted new varieties/technologies as they find them more marketable. This has been evident in Pigeonpeain Tanzania, Chick pea in India, Sorghum in Kenya and the NRM activities under Bhoochetana.

d) **Demonstrable impact :** The impact of some of these interventions were visible in one season itself and which encouraged farmers to adopt technologies and re-invest back in their farms (as in NASFAM, Pigeon Pea, Tanzania, Bhoochetana)

Constraints:

a) **Initial sensitization** and uniform understanding on IMOD. This has been addressed through internal and partner communication.

b) **Understanding smallholder farmer value chains** and market dynamics across regions as each had a different context. Ongoing process, and recent interventions and training workshops are now capturing some of these (e.g. women value added processors in Niger).

c) **To create more impact case studies** for wider dissemination among partners and policy makers–to develop more region wise (similar to what was done for the Innovation platforms in Zimbabwe, Bhoochetana in India).

d) **Partner Capacity building**: Need to hasten the capacities of partners on systems and market linked approach. Workshops being conducted to address this and articulate a shared vision to be reflected in workplans.

e) **Business Modeling /pilots:** A different set of specialized skills are required for developing business models, incubating pilots, developing partnerships who understand the language

and priorities of the private sector and markets. This will encompass skill sets as developed under MBA and rural management courses. ICRISAT has appointed a person with this background and are looking at appointing 3 Specialists – Technology Uptake and IMOD for the three regions.

3.3 Integrating into Workplans and Activities:

- **Global Planning Meeting January 2013**: All scientists gathered to reiterate/fine tune and formulate the new plans of action with the ICRISAT four Mission Goals–(i) to reduce poverty, (ii) hunger, (iii) malnutrition and (iv) environmental degradation in the tropical drylands and identified what would be needed to deliver towards those Mission Goals with the Development Outcomes that are expected to help the poor move along the IMOD path.
  All participating scientists were asked to integrate and demonstrate IMOD activities in their discussions, presentations and work plans.

- **September 2013 Management and senior Team Retreat:** ICRISAT global Management team and senior members were invited for a 3 day Retreat workshop in Hyderabad, India, organized by the Asian Institute of Management, Philippines. IMOD was extensively deliberated upon and to reiterate senior Management alignment, understanding and internalization into work plans and team orientations across CRPs.

- **Research Program Level Planning meetings:** Likewise, in 2013 the IMOD principles and related activities were discussed and debated much more in depth in all Research Program level planning meeting. It is expected that IMOD activities will get highlighted more in internal work plans as well as with those of partners/stakeholders.

- **Training cum Brainstorming sessions** on Smallholder farmer Value Chains and market linkages were also conducted for ICRISAT partners (NAREs, SAUs, NGOs, technology partners, private sector) to share and enroll stakeholders in the IMOD approach and ways to integrate into their plans.

3.4 Conclusion

With economic liberalization and markets being deregulated there has been a burgeoning and continuing interest and investment by the private sector in agriculture and agri-business and developing better value chains to meet market requirements. While ICRISAT recognizes the key role of the private sector, it has chosen to strategically converge these market imperatives with the interests and well-being of the small and marginal farmers. *By making IMOD core to its strategic vision, it is demonstrating how science and markets can convergein a "win –win" manner to create economic wealth for the small scale famers and quality produce for the consumers.* It is looking at fostering not only a faster agricultural growth but also a more equitable growth. IMOD is that vital link between markets, science and small holder farmers. ICRISAT has demonstrated that many market based solutions will necessarily need to have a solid foundation in science.

IMOD was articulated in 2010, and has called for a widespread change in thinking in keeping markets as the key drivers of economic change to smallholder farmers in the SAT regions. It is a powerful 2020 vision and is envisaged to have the potential to raise millions of farmers out of endemic poverty. Three years into the strategy, this approachis in the process of being rapidly internalized in the system. Like gender, IMOD is planned to become cross cutting across all ICRISAT research programs. The featured exemplar IMOD case studies and activities as highlighted in this note (and in annexure 2) validate the IMOD principles of markets being the engines of growth for the small and marginal farmers. It has demonstrated innovation, sustainability and replicability across some activities in Asia and Sub Saharan Africa, which will have the potential to become catalysts of change within ICRISAT and their partners.

According to IMPACT projection models, demand for cereals in the target region is expected to grow by 40% by 2020 (over 2000 baseline), driven not only by population growth, but also by regional dynamics such as the increasing demand and growing markets for sorghum beers, millets as health food, and weaning for children, for livestock and poultry feed and legumes as a cheaper source of protein, and coupled with trends towards urbanization of the population.

Given the favorable market outlook in both SA and SSA, there has never been a better window of opportunity to meet the demands of the food system in the years to come. This is an unique strategic proposition of ICRISAT as it implements its R4D agenda with interlocking partnerships through IMOD. While private sector investment in this sector is critical to success, IMOD-ICRISAT if implemented well has the potential to become the converging neutral platform to become a catalyst of large scale transformation for SAT farmers.

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Annexure-2

2 Additional IMOD related ICRISAT Case Studies /Briefs:

1. Ensuring IMOD through value addition and entrepreneurship development in Food Processing, through business incubation approach

2. IMOD at play: Scaling up technology transfer through business incubators

3. Sweet Sorghum market linkages – India and Mali

4. HOPE in Tanzania

5. Groundnut ICGV 91114 – a short-duration drought tolerant variety in Anantapur district of Andhra Pradesh

6. IMOD pathway intervention for enhancing the hybrid pigeonpea adoption to increase net income to the farmers of Maharashtra and Andhra Pradesh states of India

7. IMOD intervention for enhancing adoption of improved pigeonpea cultivar for sustainable production, food and nutritionsecurity and a betterquality of life to the farmers of Rajasthan, India.

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2.1 Ensuring IMOD through value addition and entrepreneurship in the development of the Food Processing sector.

(Kiran Sharma / Saikat Datta Mazumdar/ Aravazhi/Karuppanchetty)

Background:

The small holder farmers of the semi-arid tropics (SAT) do not get the right value for their produce due to lack of: value addition to their crops, knowledge of the nutritional value of their produce, knowledge of food safety, access to food processing technologies, processing and food testing infrastructure, guidance in the area of marketing of processed food products etc. Thus access to the modernized agro-food processing system can be a strong engine for direct and indirect growth and poverty reduction in the dry lands.

The cereals and legumes of the dryland tropics are nutritionally rich and contain many health- promoting and protecting compounds such as protein, phytochemicals, vitamins and indigestible carbohydrates etc. Thus there is a tremendous opportunity to utilize these crops to develop different value added products leading to increased demand and value of the farm produce of the small holder farmers. Further promotion of entrepreneurial ventures around these value added products and technologies has the potential to generate employment and income for the local economy, bringing in changes to lifestyles, and leading to more value creation across other sectors. Thus the smallholder farmers of the SAT need to be exposed to these experiential learning processes that will tap into the innate entrepreneurial spirit existing in the agricultural community.

The strategic insights:

In order to enhance the value and marketability of the cereals and legumes of the dryland tropics, appropriate technologies and development of value added products based on the understanding of the consumer demand is the need of the hour. Nurturing of entrepreneurs to take these new products to markets need to be further supported through suitable business incubation and linkages to the markets. The NutriPlus Knowledge (NPK) program of the Agribusiness and Innovation Platform (AIP) has been established to work in developing and promoting innovative value-added products and technologies from ICRISAT mandate crops. The NPK program further has been closely linked to the Agri-business (ABI) incubation and the Innovation and partnership (INP) program of AIP in order to provide technology support for product and packaging development, labelling and regulatory support, innovative post-harvest processing solutions and training for capacity building in food processing and food safety to prospective entrepreneurs. Entrepreneur development workshops, quality control and quality assurance training programs, street food safety awareness programs, business plan related support, conferences and symposiums have been identified as key strategic interventions to address the need for value addition and enhance marketability of the produce of the smallholder farmers. Women entrepreneurs have also been identified as key role players in this process of growth and development.

The intervention:

The NPK program presently provides technical and regulatory services and consultancy in the area of food product development, R&D consultancy (new process, product and packaging solutions), quality control and quality assurance services (raw material and finished product analysis, food safety assessments) and food regulatory consultancy (regulatory clearances for new products facilitate registration of new ingredients as GRAS, USFDA, EU, CODEX etc.) to farmers, exporters and other stake-holders in the food industry. Healthier and safer nutritious snacks made based on the ICRISAT mandate crops for the benefit of the fast food consumers has been developed by NPK. These products have higher nutritional value than rice and wheat based products besides being rich in dietary fiber, a quality that makes them diabetic friendly. Usage of food grade sweet sorghum syrup is being promoted by NPK in the food processing industry. Similar work to develop and commercialize value added products based on dryland cereals and grain legumes to address hidden hunger and malnutrition is also being undertaken. NPK also conducts entrepreneur development workshops focused on establishing and managing food processing enterprises e.g commercial enterprises based on sweet sorghum syrup. Trainings to enhance the skills of food testing laboratory personnel are also conducted to empower them to address the challenges in food safety. Strengthening the food processing and food safety infrastructure through facilitating the establishment of food processing business incubators and food testing laboratories is another key area of intervention of the AIP.

With ICRISAT's commitment to promote women entrepreneurs in the area of food processing, AIP has been working closely with the 'Association of Lady Entrepreneurs of Andhra Pradesh' (ALEAP). The ABI program with technical support from the NPK program is organizing regular training programs in promoting food processing business opportunities to the women entrepreneurs of ALEAP. These programs aim to bring out new business opportunities for agribusiness and food processing start-ups, explore ways for financing, and assess the potential of food processing for women entrepreneurs.

The impact of the intervention:

This initiative of AIP is presently working with 5 women entrepreneurs to promote sorghum and millet based products. ABI program along with NPK and INP programs is supporting these women entrepreneurs in developing and commercializing products developed using the ICRISAT mandate crops. Entrepreneurs have shown their interest in adopting technologies and commercializing products like multigrain atta, noodles, flakes and crispies, ready-to-serve beverages from sweet sorghum etc., which have been developed by the NPK program. One of the women entrepreneurs has already started activities towards commercializing sorghum crispy based premium chocolate cookies and bars. In addition, multinational companies like Unilever have now evinced interest in the dryland cereals and are working closely with the NPK program to further tap into the nutritional potential of these cereals and develop commercial health products addressing lifestyle diseases. The Government of India has selected AIP ICRISAT in implementing the establishment of 5 food

processing business incubators and 5 food testing laboratories in Africa. Thus, AIP activities of supporting and promoting entrepreneurial opportunities in the area of food processing is clearly in line with ICRISAT's Inclusive Market-Oriented Development (IMOD) approach, which focuses on linking smallholder farmers to the markets which will be able to stimulate agro-enterprises to raise rural incomes and to create opportunities beyond agriculture.

The way forward:

AIP at ICRISAT is making a continuous effort in promoting and encouraging entrepreneurship in food processing businesses with special focus on promoting innovative products and technologies based on ICRISAT mandate crops. AIP program of ICRISAT will continue to train and support startups by providing technical and business support services. Continuous effort shall be made to link the farmers and entrepreneurs to the different stakeholders across the value chain and ultimately to the markets.

Agribusiness & Innovation Platform (AIP)

2.2 IMOD at play: Scaling up technology transfer through business incubators

Background: The Indian National Agricultural Research System (NARS) is considered to be one of the largest publicly funded research systems in the world. However, gaps in its extension machinery have held back many of the research findings from reaching its intended target group- the *farmers*. Agriculture today is increasingly moving away from production-oriented mode and getting integrated into a value chain mode that has many actors and entities offering forward and backward linkages. Again, innovations from the agricultural sector also need to be brought into the mainstream. Given such a context, there is a need for holistic technology transfer models which brings together all the stakeholders and one which allows for interactions, is dynamic and flexible.

The strategic insights

Globally, entrepreneurs and Small & Medium Enterprises (SMEs) have helped in the development of many of the economies. Using local resources, technologies and manpower, entrepreneurs engage in ventures that address the needs of the local economy, and later at a bigger market scale. This fosters conditions that will result in increasing employment opportunities (predominantly for skilled labour), creation of more wealth and savings (crucial for the population at the bottom of the pyramid), development of innovative technologies, and changes in lifestyle. An entrepreneurial venture generates employment and income into the local economy; this economic cycle and the generation of demand and supply from the local economy outward leads to more value creation and ventures and thus acts as a catalyst supporting the growth of the economy.

The IMOD concept also advocates a similar approach for the growth and development of the agricultural sector, with farmers to be considered as entrepreneurs and help them move up the value chain.

However, most of such rural entrepreneurial initiative needs a support structure to deal with the issues faced in a business environment, more so in the agricultural sector where there are numerous risks. This is where business incubators play a vital role. The incubator completes the ecosystem by becoming the platform that can connect all the entities of the value chain- farmers, the NARS, market, funding agencies, suppliers etc.

The intervention

In 2003, ICRISAT started the Agri-Business Incubation (ABI) program under its Agribusiness & Innovation Platform (AIP) for promoting technologies developed from within and amongst its partner organizations and nurturing innovations from the farming community. To achieve this, ABI-ICRISAT promoted entrepreneurship in agriculture and has so far provided incubation support to more than 800 farmer entrepreneurs, apart from funding 23 agribusiness ventures and commercializing ten technologies. The scalability of the approach was proven when ICRISAT helped setup a similar ABI in the Tamil Nadu Agricultural University (TNAU), which has also been supporting many ventures.

In 2010, the Indian Council of Agricultural Research (ICAR), through its World Bank funded National Agricultural Innovation Project (NAIP) setup Business Planning & Development

(BPD) units (or agribusiness incubators) in 10 research institutes and state agricultural universities under the NARS, with ABI-ICRISAT chosen as the mentoring partner to these units. So far, this network of 10 BPDs and ABI-ICRISAT is supporting 1200 ventures, generating more than 9000 jobs in rural community.

Considering the success of the incubators, ABI-ICRISAT and NAIP developed a pilot project that centered on using the network for fast-tracking technology transfer process. During the six month period, the different phases of the project involved: shortlisting of technologies; evaluation and benchmarking of technologies; valuation of technologies and its profiling for promotion; organizing technology commercialization camps/meets at local level for identifying takers (farmers, SMEs and agro-companies) of the technology; and culminating in its commercialization. To institutionalize the process, an event was also organized to highlight the process and achievements. Overall, from 212 technologies, 80 were shortlisted, evaluated and profiled for the project.

The impact of the intervention

In a six-month timespan, 58 technologies were commercialized to 80 entrepreneurs and agro-companies, generating technology transfer revenue worth USD 0.5 mn in the process. Overall, the network has seen 165 technologies commercialized during the past three years, with more than USD 2.3 million generated as revenue to NARS. It is estimated that around 217,000 farmers have benefited through the services of the incubator network.

These numbers aside, this intervention proved that agribusiness incubators offer an effective model for technology commercialization. Augmented with incubation support services, the success rate of technology adoption is far higher than otherwise.

The nationwide business incubator network also allows the farmer/entrepreneurs to access technologies from different sectors of agriculture from any part of the country, thus enhancing scalability and replicability of the technology manifold, while at the same time ensuring sustainability of the agribusiness venture through business incubation services. This helps bring in confidence amongst the farming community to embrace entrepreneurship and to become part of the economic growth cycle.

The way forward:

The ICAR in late July 2013 scaled up the BPD initiative by adding 12 new units to the existing network. Another 50 are being planned under the 12th Five Year Plan of the Government of India. The incubator platform also allows for forming new and diverse partnership between the various stakeholders while ensuring that farmers and the farming community will be seen as the key drivers of the ecosystem and aid in improving their livelihood, ultimately benefiting the agricultural sector.

2.3 Sweet Sorghum market linkages – Case Study India and Mali

Commercial cultivation of sweet sorghum and biomass sorghum

I. Importance: The sweet stalked sorghums called as sweet sorghums are similar to the grain sorghums, but possess sweet juice in their stalk tissues that are traditionally used as livestock fodder due to their ability to form excellent silage; the stalk juice is extracted and fermented and distilled to produce ethanol. Therefore, the juice, grain and bagasse (the fibrous residue that remains after juice extraction) can be used to produce food, fodder, ethanol and cogeneration. The ability of sweet sorghum to adapt to drought, saline and alkaline soils, and water logging has been proven by its wide prevalence in various regions of the world. The per day ethanol productivity of sweet sorghum is higher when compared to sugarcane, besides it has shorter growing period of four months and low water requirements of 8000 cubic meter (over two crops annually) that are about four times lower than that of sugarcane (12–16 month growing season and 36000 cubic meters of water). Its lower cost of cultivation and farmer's familiarity with cultivation of sorghum, and their ability will aid in better adoption of sweet sorghum. The type of land, feedstock, process efficiency, and use of wastes and co-products all directly affect the net GHG and net energy performance of a biofuels production system. It was reported that the sweet sorghum ethanol value chain has higher net energy ratio of 7.5 with GHG mitigation by 86% (DBT-CII report, 2010). It is a known fact that the most favorable net energy and GHG savings result from ethanol produced from non-irrigated sugarcane and sweet sorghum. Sweet sorghum has great potential as an energy crop for first generation ethanol production, without the risk of compromising food security. Studies at ICRISAT showed that sweet sorghum hybrids had higher stem sugar yield (11%) and higher grain yield (5%) as compared to grain sorghum types, while sweet sorghum varieties had 54% higher sugar yield and 9% lower grain yield as compared with non-sweet stalk varieties in the rainy season. On the other hand, both sweet sorghum hybrids and varieties had higher stalk sugar yields (50% and 89%) and lower grain yields (25% and 2%) in the post-rainy season. Thus, there is little tradeoff between grain and stalk sugar yields in the sweet sorghum hybrids in the rainy season, while the tradeoff is less in varieties in the post-rainy season (Srinivasarao *et al.*, 2010; Kumar *et al.*, 2010; Srinivasarao *et al.*, 2011;). The experimental data on the relationship between stalk sugar traits and grain yield shows that the regression coefficient of stalk sugar yield on grain yield is not significant; thereby indicating that the grain yield is not affected when selection is done for stalk sugar yield. Hence breeding programs can aim to improve both the traits simultaneously.

The leaves and bagasse (crushed cane) of sweet sorghum are rich sources of fodder for animals. Mixed crop–livestock systems are the dominant form of agricultural production in dryland Africa and Asia. Integrating crops and livestock on the same farms helps smallholder farmers to diversify the sources of income and employment. Livestock act as a storehouse of capital and an insurance against crop production risks, a coping mechanism against livelihood shocks as well as a vital source of dietary protein. In India it was reported that

green forage is in shortage by 35%, leading to poor productivity of livestock (XII Planning commission report, Govt. of India). When sweet sorghum bagasse and stripped leaves from a wide range of hybrids and varieties were investigated for laboratory fodder quality traits it was observed that sweet sorghum bagasse and stripped leaves had almost similar fodder quality than unextracted (grain) sorghum Stover. Intake and growth trials with cattle using sweet sorghum bagasse and stripped leaves-based feed block (BRSLB) by International Livestock Research Institute (ILRI) and ICRISAT showed no significant differences between BRSLB and commercially produced sorghum stover-based feed block (CFB). In other words, sweet sorghum bagasse and stripped leaves provide a valuable, tradable feed resource that will potentially add considerable value to a sweet sorghum biofuel value chain (Blummel et al, 2009).

II. **Past development effort: The** ICRISAT-CAIT- IFAD funded biofuel project "Linking the poor to global markets: Pro-poor development of biofuel supply chains" was implemented during 2008-11. The research and developmental activities for sweet sorghum (Sorghum bicolor L. Moench) were undertaken in India, Philippines and Mali.ICRISAT has successfully deployed the improved sweet sorghum materials like ICSV 93046, ICSV 25280, CSH 22SS and JK Recova(a private sector hybrid developed from ICRISAT parental lines) in the target areas of M/s Rusni Distilleries and Tata Chemicals Limited (TCL) during 2007-11. Rusni distilleries,the first sweet sorghum distillery amenable for multiple feedstock use in India located in the Medak district of Andhra Pradesh, was established for the production of ethanol in 2007. This distillery has a capacity of 40 kilo litres per day (KLPD) and capable of using multi-feed stocks for the production of ethanol. It discintuedontinued operations since 2009, as the ethanol price of Rs 27/lit fixed by the Govt. of India is not economically viable. Similarly, TCL 30 KLPD distillery established in Nanded district of Maharastra and operated during 2009-11 was solely based on sweet sorghum. It used commecially grown sweet sorghum in the area around 25 Km radius of the plant to produce trasport grade ethanol and ENA. TCL discontinued operations since 2011. The ICRISAT variety, ICSV 93046 productivity levels in the farmer fields has recorded up to 53 t ha^{-1}. ICRISAT varieties in those years occupied about 600 ha. The total cost of cultivating sweet sorghum was Rs. 14,285 ha^{-1} while that of competing crops like sorghum was 12,797 ha^{-1} and Rs. 17,202 ha^{-1} for sorghum-red gram intercrop. For sweet sorghumthe average stalk yield was 20 ton ha^{-1} and grain yield was 0.6 ton ha^{-1}. The low grain yield was due to some of the sample farmers harvesting the crop at an early stage of maturity. Net returns of Rs. 9,503 ha^{-1} (excluding family labour) was obtained from sweet sorghum. Returns realized from sorghum and pigeonpea intercrop was the next highest with Rs. 7,765 ha^{-1} followed by grain sorghum with Rs. 5,084 ha^{-1} (IFAD project report, 2011). Similarly, ICRISAT has established two sweet sorghum decentralized syrup making units one in Ibrahimbad, Medak district, Andhra Pradesh (funded by Govt. of India in NAIP project) and another in Parbhani, Maharashtra district (funded by CFC-FAO) during 2008-11 and 2010-12 respectively. As there is no market demand for syrup, the farmer associations could not continue their operations beyond the project period.

The All India Coordinated Sorghum Improvement Program (AICSIP) has identified ICRISAT improved sweet sorghum varieties ICSV 93046, ICSV 25280 and one hybrid ICSSH 58

aresuitable for release as they stood first in the three year multi location trails of AICSIP. CSH 22SS, a sweet sorghum hybrid developed, based on ICRISAT female hybrid parent ICSA 38 was released in 2005. The Mariano Marcos State University (MMSU) has submitted released proposals of ICRISAT varieties ICSV 93046 and SPV 422 to DA-BAR for release in Philippines (Reddy et al, 2011).

III. **Current Development effort:** Currently no distillery is operating in India based on sweet sorghum for ethanol production as the ethanol sale price ifs fixed at Rs 27. Hence, sweet sorghum is promoted as fodder crop inoa limited scale. Farmers in Maharashtra, Gujarat and Andhra Pradesh are growing ICRISAT and NARS released sweet sorghum lines (ICSV 93046, CSH 22SS, CSV 24SS, RSSV 9 and Amrutha) besides local land races for feeding livestock.The US-India Consortium for Development of Sustainable Advanced Ligno cellulosic Biofuel Systems (SALBS), intends to improve sorghum biomass while growing in marginal environments of Madhya Pradesh and Gujarat for biofuel production. The current multi location trials data is promising and farmers have selected ICSSH 28, CSH 13 and Gird 12 for large scale cultivation the following year. The selected entries is planned to grow the following year in 50 ha spread over in 10 sites of project target areas. In Boochetana project, seed production of six promising sweet sorghum and biomass sorghum varieties is currently undertaken in 20 ha, to promote sweet sorghum as fodder crop in rainy season 2014 over 5000 ha (Table-1).

Table-1 Area under sweet sorghum varietal multiplication in post rainy,2013 in Bhoochetana Project

Genotype	**Quantity (Kg)**	**Area sown (ha)**
CSV 93046	40	**6.5**
CSV 25307	10	**1.5**
CSV 25280	12	**2**
CSV 25274	10	**1.5**
CSV 25315	10	**1.5**
CSV 25333	20	**3.5**
CSV 25306	20	**3.5**
Total	**122**	**20**

In Philippines, Bapamin enterprises, a farmer's cooperative is raising a SPV 422 and ICSV 93046 for vinegar and hand sanitizer production in 500 ha annually (Reddy et al, 2011).

Similarly, a private-public partnership initiative piloted by Malibiocarburant, Mali and the ICRISAT, Malian farmers led the way in integrating improved sweet sorghum into their traditional production system in West and Central Africa. The partnership has initiated the development of a sweet sorghum value-chain model focusing on integrated energy production by small-scale sorghum growers and livestock holders for local markets. The first phase will see sweet sorghum used to produce grain for human consumption, as well as fodder from the

sweet stems, and later even bioethanol from the extracted juice–food and energy all in one crop.

2.4 IMOD R&D model: HOPE project in Tanzania

Background

Semi-arid Tanzania, home to about 20% of 45m human population, is characterized by cyclic drought, inaccessibility to low- risk crop and soil and water management technologies and lack of participation in product and input markets by majority of farmers. This has contributed to low crop yields, frequent famines, hunger and acute suffering especially by women and children who are the most vulnerable to the vagaries of weather and institutional failures.

Baseline data for 2009-2010 cropping season for Singida Rural, one of 5 semi-arid districts in which ICRISAT's Harnessing Opportunities for Productivity Enhancement (HOPE) Project is under implementation, indicated that sorghum and finger millet productivity, respectively, was about 0.5 t ha^{-1};with knowledge and adoption rates of improved varieties estimated at 50% and 30%, respectively. Consequently households produce at subsistence level with no significant grain surplus for sale while the competiveness is generally low with gross margin estimates at US$ 135 and US$ 72 ha^{-1} for finger millet and sorghum, respectively. Nevertheless, with adequate empowerment of smallholder farmers and strengthened partnerships with all the major stakeholders in the sorghum and finger millet value chain, production and income earning potential for the two crops could be enhanced to over 4 times the levels reported in 2009-2010 season.

HOPE's Research and Development strategies

The key strategy was the use of integrated value chain approach which hinged on product market-led pull linked to enhanced production stimulated by stronger partnerships, improved accessibility to improved technologies and input and credit markets by resource-poor farmers. Key stakeholders (Table 1) at various segments of the sorghum and finger millet value chains were identified and invited to a workshop to identify challenges and opportunities for improvement at each node of the chain and subsequently to prepare an action plan detailing project activities for implementation and identifying roles of the various partners. An inventory of available on-shelf sorghum and finger millet technologies was identified and test-adapted under on-farm participatory technology selection procedures to identify the suitable ones for the 5 different project districts in Semi-arid Tanzania. Public-private partnerships were initiated to improve accessibility of seed, production information and product and input markets by resource poor farmers.

Interventions by ICRISAT's HOPE project

In the **research** segment of the value chain, the main challenges were inaccessibility and/or low adoption of production technologies that are well adapted to the various biotic, abiotic

and socio-economic conditions of semi-arid Tanzania. Consequently, HOPE project identified 6 and 8 improved promising and/or released varieties of sorghum and finger millet, respectively, for on –farm testing under participatory variety selection (PVS) procedures in Singida, Kondoa, Iramba, Kishapu and Rombo districts of Tanzania during 2010-2011 cropping season. In 2012, two improved early- maturing, high yielding, disease resistant and market preferred varieties of finger millet, U15 and P224, were officially released in Tanzania for use by farmers. Further, one high yielding, early maturing and industry preferred improved sorghum variety, NACO Mtama 1, was released in early 2013. Currently, in 2013, 4 varieties of finger millet, and 4 sorghum varieties and 3 sorghum hybrids are in the National Performance Trial (NPT) and it is expected that 2 varieties each of sorghum and finger millet and one hybrid sorghum are due for release in 2014. Additionally, micro-dosing, integrated striga and blast management and tied ridging technologies were test-adapted and disseminated to farmers as a package together with improved finger millet and sorghum varieties in the 5 project districts during field days.

The main challenges facing **dissemination of improved seed** hinged on inaccessibility of seed by majority of farmers mainly occasioned by: a) unavailability of quality seed; b) unaffordability of certified seed and fertilizer by majority of resource poor farmers; c) long distance to seed and fertilizer retail outlets; and d) inadequate policy support from government. Therefore, HOPE project linked with seed companies, Suba-Agro, NACO and SeedCo, to produce and distribute small packs of certified seed of improved sorghum varieties (Macia, Tegemeo, Wahi, Hakika and Pato) through Agro-dealer retail outlets located in the 5 HOPE districts. Furthermore, HOPE project, in collaboration with Extension services of Ministry of Agriculture, Food Security and Cooperatives (MAFCS), ASA, TOSCI and farmers, supported production of Quality Declared Seeds (QDS) of 5 released and one promising sorghum and 2 promising finger millet varieties which were sold in selected retail outlets at about ½ the price of the certified seed in all the 5 project districts. To further enhance affordability of quality seed to majority of farmers, HOPE in collaboration with TASTA, sensitized MAFSC and Regional Government Administration to include sorghum seed in the Government seed subsidy program that subsequently distributed certified sorghum seed to seed retail outlets in all the 5 districts at ½ the market price through the voucher system. In order to improve quality of recycled seed, training on,on-farm-seed production was undertaken during the farmers' field days.

Besides inaccessibility to quality and affordable seed, increased sorghum and finger millet **grain production** was constrained by inadequate information on improved management practices and well adapted market-preferred varieties. In 2012 about 1000 farmers (with 60% being women) were trained in the use of improved sorghum production technologies through extensive field days where improved varieties and accompanying improved management practices were demonstrated. During the field days, the agro-dealers also displayed their small packs of seed and fertilizer products. Other channels for disseminating recommended varietal and production management information were brochures, fliers, and farmer field schools. Further, to improve grain quality, training on improved postharvest techniques in sorghum and millets was also done in all the 5 districts.

Improved **grain marketing** was constrained by low grain volumes and lack of business skills by farmers. Further, lack of grain assembling structures, credit finance and absence of reliable linkage to grain buyers led to high transaction costs with the farmers unwilling to sell to buyers due to low market prices. Therefore HOPE project organized Agri-business training of trainers (TOTs) for selected farmers in the HOPE mandate districts and these trainers were facilitated to train other farmers in their local areas. During the Agro-business training, selected stakeholders in grain buying and processing businesses, including Serengeti Brewery (use sorghum for malt), Nyirefam, World Food Program, Dunia Trust and National Food Agency (NFRA), held discussions with farmers on sorghum and finger millet grain marketing and linkage prospects. Some verbal agreements were made which were later actualized between the farmers and grain buyers. Stakeholders in agricultural credit also made presentations to farmers on their available credit products to farmers. In order to further reduce grain marketing transaction costs and improve grain quality, HOPE project started working with producer and marketing groups to improve on postharvest grain handling by using mechanical threshers which were provided to the groups by the HOPE project. The groups started using the mechanical threshers as businesses ventures in which they threshed sorghum and finger millet for other farmers at a fee. Through the use of marketing groups, transaction costs were reduced and grain quality improved and negotiating with grain buyers became more structured, credible and reliable.

Impact of the interventions

ICRISAT's HOPE project main R&D thrust was to enhance sorghum and finger millet productivity and household incomes by improving farmers' access to production technologies and markets in 5 districts in semi-arid Tanzania. In the second year of the project, i.e. 2011-2012 cropping season, the project activities had spilled over to 5 other semi-arid districts fuelled by demand from farmers. In 2012 sorghum farmers in the semi-arid sorghum producing districts accessed 400 tons of improved certified seed at commercial prices, 400 tons at subsidized prices and 200 tons of QDs seed. The 1000 tons of improved sorghum seed was planted in 100,000ha of land by an estimated 180,000 farm households. With the use of improved sorghum technologies, farmers reported a yield of about 2 t ha^{-1}, up from 0.5 t ha^{-1} at the start of the project. The farmers linked to Serengeti Brewery sold about 80% of their sorghum grain at a price of about $18 per 90 kg bag. On the basis of the yield increase (and all other factors held constant) gross margin from the use of improved varieties and associated management technologies was USD 288 ha^{-1} , 400% increase compared to before the interventions. For finger millet, although U15 and P224 varieties were released in 2012, in the same year about 1000 farmers accessed about 5 tons of QDS seed which was enough to seed about 1250 ha. Finger millet on-farm yield reported by farmers in 2012 was about 1.8 t ha^{-1}- up from 0.5 t ha^{-1} at the start of the project. Due to a weaker market linkage in finger millet grain marketing, the percentage gross margin increased. Another positive impact is that most farmers now routinely buy certified sorghum seed at subsidized prices because the grain type is of the quality demanded by the industry or market.

Way forward.

In the last 3 years, HOPE Project has established the foundation for making sorghum and finger millet important cash and food enterprises for farmers in semi-arid districts of Tanzania. In future, in addition to direct support for further release of improved finger millet and sorghum varieties, the project should continue to facilitate the strengthening of the established value chain partnerships in order to operate more efficiently and more predictably through holding of regular review and planning forums and in order to institutionalize project successes, including forward contract arrangements in product and input marketing. Credit institutions should be integrated into these forums as providers of financial services needed to facilitate the business transactions of various value chain actors. The number of farmers' producer and marketing organizations should be increased while at the same time improving their governance, skills and organizational structures of the new and old groups. The project should also commission an activity to determine the level of early adoption and impact, as well as determining dissemination channels and lessons learnt that can be used to scale up successes in non-project semi-arid districts of Tanzania.

Table 1: Sorghum and finger millet value chain stakeholders in ICRISAT's HOPE project

Value Chain Segment	**Value chain actors**
1. Research - PVS	1. DRD- Department of Research and Development 2. Extension 3. Farmers
2. Seed production and distribution • Breeders seed • Foundation seed • QDS • Certified seed	1. Department of Research and Development (DRD) 2. Seed companies- Suba-Agro, NACO, SeedCo 3. Tanzania Seed Trade Association (TASTA) 4. Tanzania Official Seed Certification Institute (TOSCI) 5. Agricultural Seed Agency (ASA)- Foundation Seed production 6. MAFSC/Extension
3. Grain production	1. Government seed subsidy program 2. Individual farmers 3. Producer farmer groups 4. Agro-dealers 5. Extension services 6. Local CBOs
4. Grain markets	1. Farmer producer and marketing groups 2. Fabricators of sorghum and finger millet threshers 3. Nyirefarm food industry, Arusha 4. Serengeti Brewery, Moshi 5. Dunia Trust 6. WFP-World Food program 7. National Food Reserve Agency (NFRA)

2.5 Groundnut variety ICGV 91114 – Customized solutions for Anantapur, AP, India.

(Drs HD Upadhyaya/P Janila)

Background: Groundnut is an important crop in Anantapur district of Andhra Pradesh, cultivated in about 758, 000 ha (average of five years, 2006-2010) under rainfed cultivation. The annual rainfall in the district is about 500 mm in about 35 rainy days often accompanied with prolonged dry spells ranging from 45 to 50 days. The rainfall determines the area in Anantapur as it fluctuated from 534, 000 ha to 897, 000 in these five years. During the 12 years (1993-2004), there were only four years with better rainfall distribution when the groundnut yields ranged between 800 and 900 Kg/ha, .But during the remaining drought years it was 300-400 Kg/ha (Nigam et al). The alternative to groundnut in Anantapur is better groundnut). In a good year, such as 2007, when the area was 897, 000 ha, groundnut yields in the district were 1130 kg/ha whereas in a bad year, yields are well below 500 kg/ha. However, even in bad years, farmers in Anantapur still prefer groundnut to other crops, as beside its pods, haulms are valued equally as quality fodder to animals.

The strategic insights: Low yields of groundnut in Anantpur are mainly due to cultivation of old varieties which are susceptible to drought and foliar diseases (rust and late leaf spots) and whose growing season does not match with the growing season in the district. As a consequence the crop often suffers due to foliar diseases and mid- and end-of-season droughts. Thus there is an urgent need to replace old varieties such as TMV 2 (an obsolete variety) and JL 24, together covering over 80% area, with a short-duration drought tolerant high-yielding variety with moderate levels of resistance to foliar diseases. Such a variety would not only reduce yield variability but would also enable the farmers to move from subsistence to increased marketable surplus production resulting in economic benefits.

The intervention: The main intervention was to replace old varieties of groundnut with new short-duration, high yielding, and drought tolerant variety with moderate levels of resistance to foliar diseases. At ICRISAT, such varieties have been available since 1990s. However, during 2002-03, through funding support by IFAD, such varieties were given to farmers to conduct Farmers Participatory Varietal Selection trials (FPVS) in partnership with Acharya NG Ranga Agricultural University (ANGRAU) and a NGO, Rural Development Trust (RDT). ICGV 91114, a short-duration, drought tolerant high-yielding variety with moderate levels of resistance to foliar diseases was selected by farmers and subsequently released for cultivation in the state during 2006 (Birthal et al 2011).

The impact of the intervention: At the farm level, adoption of ICGV 91114 has a pod yield advantage of 23%, it reduces yield variability by 30% and generates 36% higher net income compared to TMV 2. Its adoption in 35% of the 758, 000 ha under groundnut in Anantapur by 2020-21 is likely to generate a surplus of about Rs 694 million a year (Birthal et al. 2011). Further, the use of haulms of ICGV 91114 resulted in 11% enhanced milk yield of livestock as compared to TMV 2 (Blummel et al 2006). Besides economic benefits, the benefits to crop-livestock production systems through the use of ICGV 91114, will contribute significantly to systems sustainability.

The way forward: Although the farmers of Anantapur district are aware of potential economic benefits of adoption of ICGV 91114, challenges related to seed systems (non-

availability of seed) are limiting the adoption and area expansion under this variety. This is mainly due to inadequate infra-structure for production and storage, break in seed chain due to frequent drought years during which seed is sold as commodity for immediate cash income by the farmers, and lack of seed subsidy for this variety.

Varieties such as ICGV 91114 provide exciting opportunities (1) to partner with Government agencies involved in seed chain and NGOs (e.g. AAI and RDT) to upscale its adoption, committed funding support from Government of AP or any other agency (2) policy advocacy for expansion of seed production, storage and distribution related to infrastructure and human resources of APSSDC and Dept. of Agriculture needed for up scaling, and (3) to rejuvenate the seed farmer associations (SFA) that were established earlier under an DOAC, GOI funded project in the district towards sustainable seed system.

2.6 Hybrid pigeonpea adoption increases farmer's incomes in India

(Drs KB Saxena, CV Sameer Kumar & Team)

Background: Maharashtra and Andhra Pradesh are the major pigeonpea growing states in India wherein crop is grown in 1.5 million hectares. Though high yielding varieties are grown in considerable area the productivity is stagnant around 500 kg/ha in both the states. Hybrids to enhance the productivity of the poor rainfed small and marginal farmers are the need of the hour to increase net income. Hybrids are also required to change the scenario of pigeonpea farmers from subsistence agriculture to high profit agriculture.

The strategic insights: To break the yield plateau in pigeonpea hybrids are the only solution. In this direction efforts were made to develop Cytoplasmic and Genetic male sterility based hybrids. These hybrids are tested extensively in both the states for 4 years and found highly promising. They have recorded 60 and 40 percent higher yields over local types and ruling varieties in the state respectively. Economical and viable seed production methodology was also standardized for alfisols and vertisols in Maharashtra and Andhra Pradesh.

The intervention: ICRISAT in collaboration with state agricultural universities, state seed development corporations, national seeds corporation, NGOS, department of agriculture, progressive farmers and private seed companies has launched massive seed production of hybrids in 500 ha during 2013 kharif season. The seed production is under taken in farmers' fields in different parts of both the states. Large scale front line demonstrations (more than 5000) are being organized to demonstrate the advantage of hybrids over local types and improved varieties.

The impact of the intervention: Farmers who are under taking the seed production of hybrid pigeonpea will gain a profit of Rs 50000/ha. From the front line demonstrations farmers will gain a profit of Rs 20000/ha. During 2014 kharif hybrid seed will be available for cultivation in 150000 ha and this will have an impact on the livelihood of small holder farmers. The seed chain will continue and a larger area of pigeonpea will be covered by high yielding hybrids which will lead to transformation from subsistence to market-oriented cultivation, which provides an excellent example of IMOD.

The way forward: With a foresight, hybrid seed production is taken up by involving all the stake holders' form the public, private, NGOs and farming communities. It will require partnership of research organizations, extension and developmental agencies, public and private seed sectors, farmers and farmers' groups.

Adoption of improved pigeonpea cultivars by women farmers for a betterquality of life in Rajasthan,India.

Background: Pigeonpeaisthesecondmostimportantpulsecropin Rajasthanbutitiscultivatedonlimitedlanddueto non-availabilityofsuitablevarieties.The lives of hundreds of smallholder farmers in the state are long affectedby frequent droughts and marginal lands. Women farmers, in particular, are largely involved in pigeonpea production. There is a need for sustainable pigeonpea production,with the promise of food and nutritionsecurity and a betterquality of life for their families.

The strategic insights : Toenhancethe productionofpigeonpeainthestate,aproject 'EnhancingLivelihoodsofResource-PoorFarmersof Rajasthanthroughthe 'IntroductionofEco-friendlyPigeonpeaVarieties'isnowbeingimplementedbyICRISATin collaborationwiththeARS,DurgapuraoftheSwami KeshwanandRajasthanAgriculturalUniversity(SKRAU).

The intervention: In 2012, ICRISAT's ICPL 88039 varietywas introduced in four districts of Rajasthan (Jaipur, Alwar, Karauli and Dausa) along with nutrient management packages suitable to the areas. Yields of around 1,900 kg/ha were recorded in the fieldswhere manure (Neem plus) was used as a basal dose. In Padasoli village in Jaipur district, a total of 177 pigeonpea demonstrationswere conducted in the village, producing 202 tons of grain with an average yield of 1,140 kg/ha.

The impact of the intervention: MunniDevi,apigeonpeafarmer,saystheintroduction ofimprovedcultivar intothevillagehasspelleda completeturnaroundinherlife."Before,I was cultivatingsorghumandmungbeanin my4acresofland,with verylowyield andreturn(Rs8,000-10,000/year).Now withpigeonpea,IearnaboutRs70,000 perhectare/year.Asmallportionof theproduce weeat athome,whilethe majorityissold tothemarket,"she says.Munni,awidowlivingwithherextendedfamily,is aprogressive womanfarmerleader participatinginICRISAT's collaborative projectonpigeonpeaproductionwith theAgriculturalResearchStation (ARS),Durgapura,Jaipur."Aside from the significant increase in income from pigeonpea production, because of its multi-purpose use We use pigeonpea in making pakoda, dal and other food preparations, while the leaves, pod shell and broken seeds we use to feed livestock, and the dried stalks we use as firewood for cooking," says Munni.

Pigeonpea cultivation has provided a great relief to rural women in Padasoli by way of eliminating the drudgery of collecting fuel wood from nearby forest areas. Now the whole village is using dried pigeonpea stalks as fuel wood. Known as the "poor people's meat" because of its high protein content pigeonpea has also become a sustainable, inexpensive source of protein especially for the children in the village.

"Before, we could not affordto buy dal for our everyday meal. Now, with the availability and affordabilityof dal in the village, I can prepare and serve my children dal anytime,"says Prem Devi, a young mother of four – ages 3, 5, 8 and 10.

Pigeonpea producers were also linked to local markets where farm produce is being directly sold at a good price. The project has installed four mini-dal mills in the villages leading to

value-additionof the farmers' produce. Some selected farmers were also trained in grading and dal making, which has helped them earn more profitsfrom the crop. In an important project activity,a group of villagers were trained in quality seed production,and in 2012 they sold over 10 tons of seed to a private seed company at a premium price of Rs.45/kg.

The project's range of activitiesfrom seed distributionto marketingand consumptionis an example of how ICRISAT's IMOD strategy functions, and serves as a model for other villages to follow.

The way forward: There is a need for the state agricultural university, department of agriculture to have proper seed chain to have quality seed production of ICPL 88039 variety to bring large area under its cultivation.

2.7 Bhoochetana: The Integrated Watershed Management Approach to increased farmer incomes

The watershed management approach was adopted by the development agencies and governments but the issues of sustainability and tangible benefits for the farmers were in question. Many policy makers and development investors were raising the questionsas to whether the watershed approach is able to make the desired impact or not ICRISAT undertook the assessment of its own on-farm watershed work undertaken in 70s and 80s along with meta-analysis of watershed programs in India. Based on the study the benefits were assessed and observed that although watershed programs were silently revolutionalising the dryland agriculture with a B:C ratio of 2:1 with the internal rate of return of 22 per cent ,however, large scope existed to increase the impact of the 68 per cent of the programs which were performing below average. The drivers of success were identified and based on the learnings new model of Integratedwatershed development for improving rural livelihoods, this was developed by ICRISAT-led consortium.

Integrated Community Watershed Model: In order to improve the sustainability and adoption of soil, water and nutrient management practices, innovative approach of ensuring tangible economic benefits to small farmholders in the watershed was developed by starting with in-situ moisture conservation and integrated natural resource management techniques.

Enhancing the green water use efficiency resulted in increased production and productivity. Following rainwater harvesting, farmers undertook crop diversification with high-value crops like vegetables and fruit trees. In addition to supplemental irrigation provided to the main crop during the drought period, through integrated approach, not only the cropping systems were diversified but also the farming systems by indicating livestock, fish, horticultural crops and microenterprises for women and landless people enhanced the income for the small farm holders.

The new policies of watershed is based on the Comprehensive Assessment of watershed programs undertaken by ICRISAT and its partners which is being applied in the whole country and during the 12^{th} five year plan, the Government of India is spending about 20,000 crores (equaling to US$ 4 billion) in five years for integrated watershed development program. Similar programs in Thailand and Vietnam have increased the investment by the Government in rainfed agriculture for improving the rural livelihoods. The Government of Philippines has initiated the integrated watershed programs at four benchmark locations.

Outputs

- New policy guidelines developed by ICRISAT-led consortium and implemented by Government of India for the new watershed management program being implemented by Department of Land Resources, Ministry of Rural Development
- In China, the Benefit Cost ratio of Lucheba watershed was 1:5 in ten years from 2003 to 2012. Total increase in the income of the villages was about US$ 15 million (90 crores) with total investment of about US$ 4.5 million by the Government of China with US$ 300000 investment through the ADB assisted project
- In Karnataka, the Bhoochetana mission project has benefitted more than 4.5 million farmers in four years with increased productivity by 20 to 66% with improved management practices over the traditional farmers practice. Net B:C ratio for the individual farmers

worked out to be 3 to 14.6 and for the Government of Karnataka the total net value of increased production was about US$ 230 million (1380 crores)

- Following the exemplar implementation of Bhoochetana in Karnataka, the Government of Andhra Pradesh the Bureau of Agricultural Research and the Government of Philippines have also launched Bhoochetana projects in the state of Andhra Pradesh and the Philippines for the benefit of millions of farmers in their region.

The CHINA intervention:

This watershed in China has become an exemplar model and the Asian Development Bank has taken-up scaling-up of this model in 5 provinces through US$ 100 million development loan with the Government of China. Similarly, the Government of India has adopted the new model and converged all the watershed programs under one Ministry of Rural Development from 2009 onwards instead of four different ministries implementing the watershed programs. The new watershed guidelines have adopted the livelihood approach with increased investments to ensure microenterprises for landless and women in the watersheds. More emphasis also has been put in the policies and productivity enhancement and development of market linkages through value addition in the watershed guidelines.

CASE Study: Transformation of Lucheba village, China, through watershed interventions –Bhoochetna Approach

The Lucheba village is no more an ordinary Chinese village but was bustling with the activities of harvesting in the morning (it was a peak season for long (6-10") green chillies, and each house member was busy with grading, packaging and weighing the produce and when we were ready to leave a, the number of long trucks were piling up the packed well printed (Luxing brand name with AAA markings) card board boxes . And on a single concrete road ,the vehicle drivers were showing their accommodative spirits by allowing the lorries to move on priority. Every day eight long truck loads of vegetables from the village are sent to Guangdong and Guangxi provinces after eight hours of travel to be delivered the next day morning for marketing. That explained the whole story of happiness on the faces of children, youth, adults as well as 80 to 90 year old family members who had their own share of work. By evening all members were busy with their age group members the youths were on bikes, the families were going out in cars and women were exchanging their notes while planning what to cook. On a motorbike a vendor came shouting to sell different kinds of tofu indicating time to cook the dinner for the families.

The transformation of Lucheba from old and dilapidated houses to brand new concrete houses with big court yards and gates, up to date gadgets in the houses was brought through crop diversification with high-value vegetables instead of corn, rice and rape seed. This was possible through integrated watershed development project of ICRISAT-ADB-GZAAS which started here in 2003 till 2006. The change started with a drinking water pipe line from the mountain spring to the village common taps and small rainwater harvesting cum storage tanks in the fields. The farmers were taught how to grow nursery seedlings, adopt good fertility management and integrated pest management options. Small number of farmers started and earned good income and during second year more farmers joined in the vegetable production group. Other group farmers started rearing pigs and poultry birds

using the revolving fund provided by the farmers. The buckwheat grass was grown by the farmers on their field bunds to conserve their soil and it became good source of feed for the pigs. Poor quality vegetables were also fed to the pigs. As a result every group member of the six farmers group started earning more money. But then came the problem of disposing the vegetables produced as the nearby villages could not absorb the increased production. Then the leaders decided to construct the village approach road so that they can transport their vegetable to the main road and reach to the city. With the help of the government and their own contributions and the project contribution an approach road was constructed for transportation. This road has since be further improved with a better design and concretized. Once the access improved, the number of farmers growing vegetables, multiplied manifold and then they formed the Lucheba Farmers Vegetable Association. The association has an elected body to manage the affairs and every three years elections are held. Each member pays 20 Rmb annually. The association has a registered brand "Luxing" which means –" Lucheba is better " . In 2003, with the support from the government a "Distant information Centre (internet cum training center) was established . Now with the help of the internet, the association started finding the right buyers and price for their vegetables. The association links the farmers to the buyers, fixes the price and buyers pay directly to the farmers,based on the produce procured.

Now every household undertakes the job of harvesting vegetables in the morning, then transporting to their houses where grading and packaging is done and then in the late afternoon packed vegetables boxes are collected for transportation.

Ever one in the village is fully occupied every day and as a result they can boast that Lucheba is leading the province with almost double the per capita income of Rmb 8100 as compared to per capita income of Rmb 4753 of the province and 5840 Rmb at the township level. That's how Lucheba has been transformed from subsistence agriculture town to a marketable surplus economy through an integrated watershed management approach which had the DNA of not only holistic approach but also inclusive market oriented development from the beginning of 2003.

2.8 Enhanced Utilization of Sorghum and Pearl Millet Grains in the Poultry Feed Industry to Improve Livelihoods of Small-Scale Farmers in Asia

ICRISAT along with the participation of the local partners are currently implementing a project on "Enhanced Utilization of Sorghum and Pearl Millet Grains in the Poultry Feed Industry to Improve Livelihoods of Small-Scale Farmers in Asia" funded by the Common Fund for Commodities (CFC) and FAO as the supervisory body. The project target regions are in India (2 clusters in Andhra Pradesh and 3 clusters in Maharashtra); China (1 cluster in Lioning province) and Thailand (1 cluster in SuphanBuri and NakhonSawan). The project engages with key stakeholders that includes the seed and grain suppliers, credit agencies, poultry feed manufacturing companies, and poultry producers, and other end users. Overall the project covers 80 villages and 6500 farm families in these three countries. The overall objective of this intervention is to increase the income of farmers by 15% at the end of three years of the project intervention.

Nature of project intervention and partners

The main objectives of the project intervention are on enhancing crop production using improved production technologies, bulking grading and storage of grains and ensuring better input and output linkages. *The project intervention was farmers' centered, innovative, gender and equity focused addressing various aspects of farming from plough to plate.* A new concept of "Bulk marketing" was evolved and implemented throughout the project. It involves the complete bypassing of all the intermediaries of the traditional supply chain and the direct sale of produce from the farmers to the industrial consumers such as poultry feed manufacturers, poultry farmers (who have in-house feed manufacturing), breweries, distilleries and mushroom farms. Under the project the farmers were grouped into associations and trained in use of improved crop production and harvesting technologies, grain storage, grading, bulking, and bulk marketing to avail benefits of economies of scale.
A unique feature of the project adopted is the approach of a "shared vision " and the coalition of various institutions and entities based on the principle of mutual synergistic support that can be defined as the process in which distinct and independent entities (partners with different backgrounds and expertise) join together to work towards a common goal, while meeting their sub- goals. It was a mutually supportive value chain approach with each participant contributing their expertise to an overall common benefit to all.

Other than ICRISAT the key partners involved in the project include the following : Acharya NG Ranga Agricultural University (ANGRAU), Hyderabad, Andhra Pradesh; Marthwada Agricultural University (MAU), Parbhani, Maharashtra; Andhra Pradesh Federation of Farmers Association (APFFA), Hyderabad, Andhra Pradesh; KrishiVigyan Kendra (KVK), Beed, Maharashtra; JK Agri-Genetics, Hyderabad, Andhra Pradesh; Janaki Feeds, Hyderabad, Andhra Pradesh . In China it was the Liaoning Academy of Agricultural Sciences, Shenyang, and local partners , while in Thailand it was the Field Crops Research Institute (FCRI), Bangkok and local partners.

Impacts

To measure the impact of the project at the farm household level an impact assessment survey was carried out and the findings compared with the key parameters from the baseline

survey carried out under the project prior to its implementation (before and after). Additionally, farmers from control villages (not participating in the project) were surveyed for a 'With and Without Comparison' i.e., with project intervention and without any intervention.

The findings from the impact survey indicate that farmers participating in the project were able to increase their returns from growing sorghum / pearl millet compared to the returns prior to project implementation. Net returns increased across the board in all clusters of the project. On an average the returns increased at least *four fold* for pearl millet farmers in India (mainly Palvai cluster in Andhra Pradesh). For sorghum, the net returns in the Indian clusters of Andhra Pradesh and Maharashtra more than *doubled.* The increase in net returns for the project farmers in all clusters under the project can be attributed to yield increases due to the adoption of improved technology, the higher prices that the farmers were able to command owing to bulk marketing of grain, and the increase in output prices for all commodities driven by global price rise.

In China, for the project farmers sorghum yields were higher by more than 5% compared to baseline yields and farmers obtained 33% higher prices. The yields and prices were also higher for the project farmers compared to non-project participating farmers ensuring higher net returns due to project intervention.

In Thailand, two kinds of sorghum are grown, white and red. For white sorghum grown in SuphanBuri and Kanchanaburi provinces yields increased by 40% compared to the baseline, and prices increased by 48%. Net incomes increased by about 100%. For red sorghum the commonly cultivated type in Thailand net returns increased by nearly 150% on an average.

2.9 Use and Sustain ICT innovations for bringing Research into Practice

Building a multidisciplinary platform that links science with technology.

Dileepkumar Guntuku

Multidisciplinary institutions need to develop, use and sustain ICT innovations for linking research, extension and markets, thereby bringing research into practice.

The current yields in the smallholder farmers' fields are well below their potential; the yield gaps vary by anything between 100-300% across different crops. An important factor is a lack of awareness of, and lack of access to, high quality inputs such as seed, fertilizer, and agro-chemicals. Furthermore, smallholder farmers do not employ improved crop management practices and their post-harvest management strategies are inadequate primarily due to a lack of knowledge. Farmers are also marginalized from participating in markets due to unreliable productivity, a lack of market information, and weak market linkages.

For a more food-secure world, it is imperative that millions of resource-poor small farms in developing countries significantly raise their agricultural productivity, are more resilient to

shocks and seize opportunities to increase their incomes. To do so, farmers need to be able to access and effectively use the right information at the right time.

Public-funded agricultural extension, which played a key role in bringing research into practice during the green revolution, is often inadequate in terms of infrastructure and human resources to meet the needs of smallholder farmers. The development of ICTs now is helping extension become more efficient and farmer-friendly, with real-time advice.

Yet, despite many successful ICT pilot initiatives, reaching out to these farmers with the right information at the right time is still largely an unmet challenge.

To meet the challenge of providing smallholders in India and sub-Saharan Africa with information, the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT) has opened a Centre of Excellence (COE) in ICT innovations for agriculture. The COE has developed many information systems, linking research, extension and markets. In south India, for example, in South India - internet-equipped village knowledge centres and mobile mediated voice communication platforms provide up-to-date information on best farming practices, including climate adaptation methods, crop rotation, diversification and pest management for crops such as millet or sorghum. These platforms have helped around 46,000 farmers in 21 villages in one of the poorest regions of south central India, including women, become more food secure and resilient to drought. "Earlier we used to take advice from the shop dealer on mixing of pesticides," explains Satyanarayana Reddy, a farmer from Jaanampeta village. "Now with ICRISAT's information advisory service we are able to figure out the accurate dosage. It saves money." Says Narmadamma from ICRISAT ICT Rural Hub.Plans are currently underway to replicate and expand voice message model across Asia and Africa through a financially sustainable public-private partnership model.

ICRISAT distributes GIS derived micro-level drought vulnerability maps at the beginning of the planning season so that farmers can adjust their plans. These maps are popularly known as drought maps among the rural communities in Addakal. A drought map tells how much drought to expect in any village of Addakal in the coming year given a predicted annual rainfall.

Providing free web-based access to research is another priority for international research and development centres. A virtual knowledge series platform, known as KSIConnecthttp://www.ksiconnect.icrisat.org/, enables ICRISAT to highlights their most interesting projects, cutting-edge research, and fascinating stories to a global audience. This platform also allows experts across the globe to share their project experiences and research results. KSI Connect provides agricultural stakeholders with direct access to technical experts and the latest scientific innovations in agriculture, without having to participate in face-to-face training sessions. Since its launch in July 2012, more than 150 videos have been uploaded and more than 75 countries, with around 3,000 users visiting KSIConnect every month. This platform also enables ICRISAT to organize periodical expert-farmer interactions.

ICRISAT has launched an Open Access Repository http://oar.icrisat.org in May 2011 to provide an easy interface for researchers, practitioners, or web-connected farmers to use, build on and share research conducted at ICRISAT. Since its creation more than 144,000 documents have been downloaded by people from more than 70 countries, with around 6, 000 unique users visiting the Repository every month.

The rise of new ICT devices such as tablets and smart phones will certainly create new opportunities for user-friendly information tools for better agricultural advice services and inform farmers about quality inputs and market access. They will also create job opportunities for info-entrepreneurs that can create crucial added value for farmers. Current research will provide insight into how a sustainable 'backbone communication network' can be developed to improve the quality and convenience of information (crop, market, weather and user's choice) dissemination to smallholder farmers and transparency within the value chains. To significantly scale up this 'knowledge to the poor' revolution, research, development and private sector organizations have to work together to develop and sustain new ICT innovations.

2.9.1 IMOD Case Study: ROLE OF ICT :KrishiGyanSagar and Krishi Vani

a) Background

Achieving food self-sufficiency, accessibility, and affordability remains a challenge to the rural poor in the developing world and the role of the smallholder farmers' is critical in meeting these challenges. In spite of the role to be played by the smallholders there is a greater disconnect between smallholder farmers, research labs, quality input suppliers and markets. Thus it is very important to establish linkages between research-extension-markets through innovative ICT enabled knowledge platforms.

b) **The strategic insights.**

ICTs play an important role in agricultural value chains, with different types of ICT having different strengths and weaknesses when applied to particular interventions. The impacts of ICT are diverse, and they influence market competitiveness in different ways. We sincerely believe implementing ICT that connects farmer with consumer will solve the problem to a greater extent, by creating a win – win situation for all i.eproducer – consumer – Mrittika (say an Incubated Private Company) and KrishiGyanSagar. (KGS is the interface connects and bonds all).

c) The intervention

This intervention is to be made in identified crops and these crops are selected based on the major cropping systems in our selected experimental hubs and requirement at consumers staying at identified gated communities. Based on these parameters we identified the following crops for their locations.

Targeted Locations (3) & Crops (5):

1. Anantapur: Paddy, Pigeon pea, Groundnut and Pomegranate.
2. Addakal: Paddy, Pigeon pea and Groundnut.
3. Nalgonda: Paddy, Pigeon pea and Sweet Orange.

Targeted Farmers: 5000 + 5000 + 5000 = 15,000 (Need to register farmers raising above crops only)
Targeted Consumers: 5,000 – 10,000 Nos.

Incubate of FPO/Private Company will procure; do value addition; transport and sale the farm produce. FPO/Private Company (Mrittika) will use our tablet application & server resources and will do business with our farming and consumer communities. We will provide a module where Mrittika can register the consumers with our platform and can generate automatic e.mail/ SMS alerts whenever produce is available to sell. We need to work on cost benefit model for each crop, each location for all stakeholders farmer, Mrittika and for KGS to sustain.

d) **The impact of the intervention**

It is clear the impact of ICT in Agriculture Value Chains is diverse, and influences the market competitiveness in different ways. Given the importance of context and the rapid development technology, it can be difficult to determine whether the appropriate tool now will persist in being the appropriate tool in the future. The immediate impact of intervention is socio-economic development of small holders involved and sustaining the KrishiGyanSagar application by implementing income generation model, thereby allowing scale-up and sustaining the services of KGS to happen.

e) **The way forward**

- Replicate and upscale KrishiGyanSagar services to see greater impact - for all the districts of Karnataka & Andhra Pradesh and in selected locations of Africa by bringing all consortium partners together, to provide quality inputs, best practices and market intelligence.
- Work towards release of KrishiGyanSagar 2.0 which includes module for allowing e-commerce and/or m-commerce which allow business commerce to happen directly between consumers and small holder communities. This will enable a win – win situation for all parties (1). Consumers (2). Small holders and (3). KGS Platform. Consumers and small holders get better produce & better price respectively and KGS is expected to generate revenue out of transaction made through KGS Platform thus making the platform sustainable.

- Extend services of Krishi Vani to Consumers based out of Metro cities. Initial target would be selected Resident Welfare Associations of Greater Hyderabad.

2.9.2 IMOD CASE STUDIES: BRIEF ON AGROPEDIA

a) Background

- Access to information and knowledge is limited for both farmers and extension workers .
- No information architecture available for collating and organizing the content

b) The strategic insights

- ICTs can be harnessed to address the issues mentioned above
- Can be achieved through strategic partnership with competent partners

c) The intervention

- A Knowledge management platform agropedia was conceptualized, developed and launched with support from NAIP/ICAR
- It serves as an open access digital knowledge repository
- A mobile based platform vKVK was deployed for disseminating knowledge to farmers as voice messages through mobile phones.
- Under a pilot study ICRISAT facilitated 20 KVKs in five states to disseminate agro-advisories to nearly 20,000 farmers

d) The impact of the intervention

- Being built on open access platform the knowledge is freely available to all stakeholders
- As knowledge dissemination is through mobile phones as voice messages, it overcomes barriers related to language, literacy and social status of farmers.
- Limited feedback survey indicated that the farmers saved time in accessing information, and they were benefitted by cutting costs and increased yields and farm profits.

3 Some key Partners / Stakeholders: South Asia and Sub-Saharan Africa

Kenya

- **Africa Harvest** (Contact: Nehemiah Taylor) is a well-established NGO based in Kenya (www.africaharvest.org) and with a focus on making science relevant to smallholder farmer holdings. They have worked on banana Tissue culture, sorghum, legumes, green gram, cowpea and pigeon pea. They have funding from IFAD and other multilateral agencies and have a staff of 50 people.

- They are working closely with ICRISAT in Kenya and Tanzania for sorghum with a value chain approach , linking farmers to the Sorghum beer malting industry (Kenya Breweries ltd) under HOPE project and also the SMU project (Sorghum for Multiple use). The project farmers have supplied over 2000 metric tons of ICRISAT sorghum varieties to Kenya Breweries using a grassroots farmer aggregator model .Along with ICRISAT they understand the importance of looking at the market dynamics and inclusiveness while framing any farmer intervention.

Tanzania

- **SARI –Selian Agriculture research Institute**, (Key Contacts Dr Stephen Lyimo, Dr Fridah Mgonja) Arusha, under the Ministry of Agriculture, Tanzania, has been a close partner to ICRISAT over the years. They have collaborated with ICRISAT and released new fusarium wilt resistant Pigeon Pea varieties which have been well adopted by the farmers. Acreage grew from the markets developed with growing production with exports to India and niche markets in Europe. With their partnership PP is very well scaled out In the Northern Zone (Arusha and Babati) accounts for almost 80 % of Pigeon Pea production in Tanzania. A large part if which is exported to global markets. On the production side they also work closely with NGOS like CRS, Technoserve in Farmer group creations, training, marketing etc. For more market led research SARI and ICRISAT also network with companies like Export Trading Cos , Kamal Agro to support their supply chains

- They also work on Sorghum with ICRISAT under the HOPE project on productivity enhancement of small holder farmers but more importantly also are networking with Sorghum beer malting cos (Serengeti Breweries)for market linkages .They work with closely with farmers with improved varieties and technologies but also in capacity building an training on

- **Serengeti Breweries** (contact: Julius Nyaki) is part of the global MNC Diageo Spirits and have a well set up Brewery in Arusha. They have two brands for sorghum beer-Seneta (100%

sorghum) and Serengeti (40% sorghum).Their community development officer works with SARI and ICRISAT for market led production with farmer groups in the region. They are training farmers on standards and how to improve on starch content for white sorghum. The market is growing and the company is keen to scale up with farmer linkages.

Malawi:

- **Peacock Agri Services** (Contact Susan Kamkosi) is Lilongwe based firm and has worked closely with ICRISAT on developing ICRISAT Groundnut varieties as foundation seed. They are engaged in Contract farming , farmer training (covering aflatoxin control), field advisories from planting to harvest (3 visits per season) and farmers are paid a premium over the commodity price. They work with about 500 farmers . They have 3 outlets and sell GN as seed and commodity as well as other agri inputs. They are a member of the seed Traders Association of Malawi (22 members) and the MASA seed alliance and sell certified seed. Farmers have experienced better productivity yields while they market GN to various traders and exporters.

- **NASFAM:** (contacts Alexander Chikapula, Frank Masankha) started with the objective to access better markets for farmers. They work closely with ICRISAT and have adopted all the ICRISAT varieties for Groundnut and Pigeon pea. They have a very extensive farmer network through 65 extension staff working with 1475 lead farmers who in turn handles 3 - 5 farmer clubs of 20-25 members with an overall membership of 100,000. Membership to the club is Kwacha 250/- per annum .They give integrated services to the farmers covering seeds, agri-inputs, credit from banks and output purchase for domestic and export markets. They test for aflatoxin using the vicom testing kits. NASFAM also has value added GN processing unit for branded (NAS NUTS) small packets for the domestic market.

- **AISL** (Contact Fredric Kawalewale) , has worked closely with ICRISAT on popularizing ICRISAT variety GN (MASA seed alliance) with farmer groups (150 groups of 25-30 members each) . AISL also supplies agri inputs to these groups. AISL also trains on quality standards and has invested in moisture meters, grading machines etc. On output marketing AISL trains these farmer (on standards) and supports farmer to register on the spot commodity exchanges (ACE and ACH) and establish contracts of a minimum 3 mts lots and with the groups is able to generate volume (FDH bank is the clearing bank). Farmers appreciate the transparency in prices, quality standards and traceability. He has GPS mapped 1080 Agro dealers in Malawi for better access to the farmer groups.

Zambia:

- **Eastern Province Farmers' Cooperative (EPFC)** NGO– (Contact Rosie Hoare) Established in 2007, EPFC have been working with ICRISAT the past 5 years on GN seed multiplication farms and have developed a farmer level seed certification initiative. Presently they work with about 3500 farmers in 5 districts of eastern province. Through 4 senior field officers they provide training on agronomic practices and on Afltaoxin control. They have invested in a GN decorticating plant, laboratory, weighing scales etc. and procure GN from a lead farmer aggregator model. The target market is South Africa which has an apparent shortage of GN (for edible oils). There present export is about 350mts with plans to scale up to 2000 mts and working capital is a constraint.

Niger:

- **ETC-Enterprise de Transformation des cereales**: (Contact MrsLiman): Lady Entrepreneur & Processor: As sole-proprietor of ETC MrsLiman is running a processing unit (grading units, sorter, milling) for value added products from millets, sorghum, rice, maize etc. into products like KhusKhus, flour, paste, degue, and are sold in consumer packs across 36 outlets in Niamey . She sources her raw material directly from 9 women farmer groups of 30-50 members each. These farmer clusters have been created by ICRISAT's NAREs partner, INRAN. While ICRISAT varieties in Millets and Sorghum are grown, INRAN trains the farmers on better farming practices and quality standards. The quality of the produce is monitored by INRAN before supply to ETC. The farmers are paid a premium of 20% over the market prices. The market for these value added products are growing and the margins are attractive. She is also President of the Women Processors Association in Niamey and is a role model for other lady entrepreneurs. Her margins range from 40-50% and she is keen to scale out with more investments in dryers, decorticator and a packing unit.

- **INRAN:** (Contact Kaka Saley, Yaye Hama), part of Ministry of Agriculture: They have worked closely with ICRISAT in popularizing ICRISAT varieties and technologies among more than 20 farmer groups. They support the creation of farmer clusters, train and develop capacities on best practices, farmer field adaptive trails, quality standards, and also advise/support on any value addition processing. They also monitor quality of produce for select value added processors. They have well equipped laboratory for checking quality of the products

India:

- **Acharya NG Ranga Agriculture University: ANGRAU: (**Contact Dr. Padmaraju, Dr.Suhashini): ICRISAT has close linkages with this SAU based in Hyderabad for a long time. Close association with their Regional research centers in Nandyal saw the development and introduction of Chickpea varieties in the area for a large scale farmer adoption and market acceptance .Likewise with their Guntur Lam center for the development of Chickpea and Pigeonpea. ICRISAT works closely with their socio economic team for conduction various farmer level studies and evaluations.
- *Note: ICRISAT has numerous partnerships across research programs and geographies and the above are just a few that were met during this study)*

<u>Some Farmer Groups Interactions</u>

Tanzania:

- Rombo village, Morsi: Alongwith the partners from SARI. The group of about 30 farmers was very happy with the support of ICRISAT/ SARI. The sorghum variety they were growing was giving a better yield and they were able to sell to Serenegti Breweries. SARI played the networking role of linking them to the Brewery and along with representatives from brewery conducted training programs on quality and standards. The project also supported them with a cleaning machine.

Niger:

- GuidianGaba Village, Dosso: Alongwith ICRISAT team met 30 empowered women farmers involved in seed production, and value addition of GN (decorticating and processing for oil, butter and oil cake). The women were very enthusiastic and with the various training programs and varieties from ICRISAT and INRAN were able to earn more than 50% versus what they earned in the past. Farmer to farmer scale out is happening.

Zimbabwe:

- Matapos region, Bulawayo: A group of 8 farmers who worked with ICRISAT on the innovation platforms for Livestock .They were pleased with the efforts taken by ICRISAT in developing the auction yards and the training on management of the same. This has enabled them to get better and more transparent prices in the lean season. Also the advice on growing the quality of bana grass and maize stover for feed has been very useful.

India:

- Kurnool district, AP: The group of 8 farmers was extremely pleased how ICRISAT varieties like JG11, KAK 2 have enhanced productivity so much and found good market acceptance. Growing market demand has encouraged them to re-invest back in their land to earn more profits. They have moved from subsistence farming and are now very well-tuned with the market demand and supply and deal with markets in Bangalore, Chennai and Indore.

4 Views on IMOD:

Internal: IMOD has meant different things to different people depending on their background. While some have been extremely motivated by it some confuse it with pure value chains. New skills set development and continuous capacity building was felt to be needed to broad base IMOD deeper and across all functions. Though it is a very inspirational vision it has to integrate to individual roadmaps and IMOD deliverables need to articulate adequately. It has given many a sense of confidence and conviction in their activities – especially for those in direct farmer and partner contact. The emphasis on markets has helped them to re-orient their research better and ask better questions. Others also felt that working with markets is a very effective model to bring about real change because it is driven by real incentives and clear visible impacts. The rewards are external to projects and we can engineer positive feedback loops to increase sustainability and build resilience in dryland systems

The IMOD diagram in a single frame captures the essence of what we need to do –it is very motivating and has given us more confidence. ***....***

Internal staff ...

Partners: Some key partners have belief in the markets approach and integrated well with ICRISAT's vision. Though IMOD may not be clearly articulated, the acts and alignment have been evident. Traditional partners and more so in the R&D. NAREs are still grappling with the "inclusive smallholder farmer and markets approach" and do not have any market orientation and have expressed that their key staff need to be exposed and trained on this. More communication and enrollment of partners to IMOD will need to be scaled out.

Farmers: As the focused key beneficiaries of IMOD, all farmers have appreciated the markets orientation of ICRISAT and partners. Many have liked the farmer group aggregation model as it has improved their bargaining power while meeting market needs. As their incomes increase capacity building up the development pathways will need to be on a regular basis initially. More farmers are seeing the advantages of working in groups in terms of seed systems, input and output aggregation and better bargaining power in the market place. Some farmer groups are also looking at basic village / community level value addition and processing options for better value capture.

Annexure-5

5 Secondary and Primary Sources of the Study

Secondary Sources: The following are the internal documents referred to (detailed list in annexure 2 with web links).

a) ICRISAT Strategic plan 2020
b) ICRISAT Business Plan 2011-2015
c) ICRISAT Medium Term Plan :2011- 2013
d) Implementing Inclusive Market Oriented Development in the CGIAR Research Programs – Frequently asked questions (FAQ) on IMOD
e) Enhancing Small Holder farmer participation in Markets - The IMOD way ; DG's speech at Dr. MS Swaminathan Agricultural Leadership award function, June 2013
f) Brainstorming on Achieving Inclusive Growth by linking farmers to Markets-TAAS, ICAR and ICRISAT
g) CGIAR Research programs on Dryland Cereals
h) CGIAR Research programs on Grain Legumes
i) Scientist Work plan and Excel sheets
j) Director General's Blog on IMOD.
k) ICRISAT Eastern and Southern Africa Highlights
l) ICRISAT West and Central Africa Highlights
m) The Jewels of ICRISAT
n) Science of the Articulate: IMOD as ICRISAT's and Partners New Drylands Strategy – Frank A Hilario
o) Strategies & support mechanisms for promoting Entrepreneurship in the Food processing Sector for IMOD

Furthermore, also extensive reference to publications on Markets/Value Chains/Inclusiveness by the World bank, UNDP, Harvard University, IFC,USAID, Govt of India, and similar (as listed in annexure 1 with the web links)

Primary sources:

A total of over 145 people were interviewed in both SA and SSA.
(Internal) ICRISAT: Personal Interviews and discussions with 40 scientists at ICRISAT headquarter, and 36 scientists located in Sub Saharan Africa in ESA and WCA covering the following aspects:

a) Pre-IMOD activities –markets and value chains
b) Formalization of IMOD in 2010
c) Perceptions of IMOD – activities and workplans
d) IMOD communications
e) Learnings

External Stakeholders- NAREs partners, farmers, processors, value chain players and policymakers. (About 41 senior stakeholders in South Asia and 28 in Sub Saharan Africa)

a) Awareness of IMOD or similar Inclusive smallholder farmer approaches

b) Their Strategic approach
c) Opportunities and challenges in smallholder farmer Linkages

A total of about 81 people were interviewed -- internal and external in South Asia.
A total of about 62 people were interviewed –Internal and external in Sub Saharan Africa

Farmer Group meetings:

a) Chickpea farmers, Kurnool, AP, India
b) Pigeonpea farmers, Gulbarga, Karnataka, India
c) HOPE project farmers, Rombo Village Morsi, Tanzania
d) Stakeholders Workshop at SelianAgri Research Institute (SARI), Arusha, Tanzania
e) Groundnut farmers in Chaomba Village, Lilongwe, Malawi
f) Groundnut Farmers in Yohann Village, Chipata Zambia
g) Livestock Farmers in Matopas, Bulawayo, Zimbabwe
h) Groundnut women farmer cluster groups (seed + processing +oil +oilcake), Dosso region, Niger
i) Women processors of Millet and Sorghum in Urban Niamey, Niger.

About **ICRISAT**

ICRISAT
Science with a human face

International Crops Research Institute for the Semi-Arid Tropics

CGIAR

ICRISAT is a member of the CGIAR Consortium

The **International Crops Research Institute for the Semi-Arid Tropics** (ICRISAT) is a non-profit, non-political organization that conducts agricultural research for development in Asia and sub-Saharan Africa with a wide array of partners throughout the world. Covering 6.5 million square kilometers of land in 55 countries, the semi-arid tropics have over 2 billion people, of whom 644 million are the poorest of the poor. ICRISAT innovations help the dryland poor move from poverty to prosperity by harnessing markets while managing risks – a strategy called Inclusive Market-Oriented Development (IMOD).

ICRISAT is headquartered in Patancheru near Hyderabad, Andhra Pradesh, India, with two regional hubs and five country offices in sub-Saharan Africa. It is a member of the CGIAR Consortium. CGIAR is a global research partnership for a food secure future.

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