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Indian Agriculture: *Case studies of Proagro and IRRAD*

By

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Key words: Green Revolution, High Yielding Varieties (HYV), NGO, Cluster, Rural Development, Seed Industry, Hybrids, Biotechnology, Liberalization, Subsistence Agriculture, Marginal and Small Farmers

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ABSTRACT

India's Green Revolution of the late 1960s and early 1970s was an outstanding success, resulting in dramatic increases in wheat and rice productivity. Within a few decades, however, agricultural output in India began to stagnate while population continued to grow unabated. The political leadership was concerned about the impasse and recognized the need for the next

level of technology in agriculture. In the 1990s, Indian agriculture made a significant addition to "open-pollinated technology" by adding "value-added hybrid technology" in several crops. Unlike the Green Revolution, which was led by the public sector, this new wave was ushered in by the private-sector seed industry, of which the Proagro Group of companies was a leader. The success of Proagro attracted large investments in the seed business by many entrepreneurs, and India now has a highly vibrant private-sector seed industry that is growing at about 15% per year. The stable growth in agriculture freed up resources that contributed to growth in other sectors, thereby helping India's emergence as a prominent global economy. In recent years the agricultural growth in the country has slowed, which is a matter of serious concern. India is now looking to develop agrobiotechnology, sustainable agriculture, and secondary food sectors to provide food security for its growing population.

The precarious health of Indian agriculture derives from a fundamental divide between two distinct farmer classes. Only the upper 20% of farmers, those who are relatively modern and affluent, have a meaningful impact on growth in the agriculture sector. The remaining 80%, the marginal and small farmers, have been largely bypassed by agricultural advancements and are totally dependent on the vagaries of nature for their sustenance. It is imperative to bring this segment into the mainstream through specialized efforts at the village level. The Institute of Rural Research and Development (IRRAD) is a nonprofit organization engaged in such an effort.

The Pioneering Vision of Proagro

The Proagro Group was established by a non-resident Indian, Suri Sehgal[1], in 1988 when the Indian economy was starting to open up to global trade. Proagro took advantage of the liberalization and introduced hybrid technology into carefully selected food crops. The high-quality hybrid seeds were rapidly adopted by millions of farmers, making Proagro one of the largest hybrid seed companies in the country within just a few years.

Proagro's greatest asset was its excellent products. Its research program produced outstanding hybrids of maize, rice, sorghum, millet, sorghum-sudangrass, sunflower, and several vegetable crops. The extra grain production from Proagro hybrids helped to meet the annual food needs of millions of people and contributed millions of dollars annually to India's GDP.

Proagro raised the benchmarks of the seed industry in India. Its seed processing plant at Toopran in Andhra Pradesh and its use of information technology to manage its operations were cutting-edge for India at the time. During its early period of rapid growth, Proagro tapped global technical expertise and established linkages with other institutions in India and abroad. In 1993 Proagro formed a joint-venture company, Proagro-PGS, that was instrumental in bringing agrobiotechnology to India. It was the first in the country to file for government regulatory permits for transgenic crops, which prompted the government, having no prior experience in this area, to establish a new regulatory system to process the applications.

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[1] Suri Sehgal holds a PhD in plant genetics from Harvard University and a diploma in business management from Harvard Business School. During his career in seed enterprise he made an immense impact in many developing countries in Asia, Africa, Latin America and Central Europe. Dr. Sehgal was the recipient of Hungary's National Agricultural Award in 1994 and was a member of the Indian Planning Commission's Technical Advisory Committee on Secondary Agriculture.

The legacy of Proagro is its high-quality products, still in wide use today, and the set of leaders who emerged from the company and are now the cream of the Indian seed industry. Proagro Group was acquired by Hoechst Schering AgrEvo in 1998 and is now owned by Bayer of Germany.

Marginal and Small Farmers Require Special Attention

After the sale of Proagro, Dr. Sehgal put the majority of the proceeds into a charitable foundation dedicated to empowering India's rural poor. The Sehgal Foundation founded IRRAD[2], based in Gurgaon, to research and implement programs at the village level. It also established the Crop Improvement Research Program at the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT)[3] in Hyderabad, and it supports the Center for Conservation Science, Bangalore. Unlike the affluent farmers who adopt individual interventions, the marginal and small farmers of India require a holistic approach that addresses their overall poverty, including the need to improve their agricultural productivity. IRRAD's grassroots effort comprises programs in water management, education, health, agriculture, vocational training, alternative energy and rural governance. Transformation is brought about through IRRAD's collaborative initiatives with various stakeholders such as villagers, local governments and village councils, as well as through corporate-social-responsibility initiatives of industry.

Scope of the Paper

This paper describes the transformation of the Indian agricultural economy through case studies of Proagro and IRRAD. The Proagro case study illustrates the principles that lead to successful institution building, and is a replicable model. The 17 persons who were interviewed were earlier heads of various functions at Proagro and are now in leadership positions in the Indian seed industry. The IRRAD case study leads to a set of recommendations for marginal and small farmers. Both Proagro and IRRAD are the work of the same expatriate, which highlights the potential role that expatriate technologists can play in the transformation of less developed economies.

INTRODUCTION

India is a land of paradoxes, with many strengths and debilitating weaknesses, and thus can be viewed as a prototype for emerging economies. This paper addresses some of the challenges facing India's agricultural and rural economy, which would be of value to policy makers in other developing countries.

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[2] The Sehgal Foundation was accorded Special Consultative Status by the Economic and Social Council (ECOSOC) of the United Nations and participates in the Clinton Global Initiative.

[3] Dr. Sehgal is keenly aware that patents and intellectual property laws can hinder access to diversity by the public sector and small-scale seed entrepreneurs. He is an outspoken advocate of keeping expertise and germplasm in the public domain. The Sehgal Foundation undertakes and supports public, non-profit plant breeding research at international agricultural research centers including ICRISAT and CIMMYT, particularly on crops that are of great importance to subsistence farmers.

The strengths are impressive. Indian industrial growth has not flagged even during a stagnant world economy. India's IT industry has become the back office to the developed world, and its national capabilities in scientific and security fields are immense. The country has a huge agricultural base and, in spite of many problems facing agriculture, is almost self-sufficient in food.

India's weaknesses are well known. Its UN Human Development Index ranking is currently 132nd out of 179 countries. 836 million people live on less than Rs 20 a day (Aiyar, 2009). In recent years, the agricultural growth rate has been 2% or less.

In India it is not difficult to find a story like that of "Majid" and "Uday."

Majid is a prosperous farmer who grows the latest generation of Bt cotton in Uttar Pradesh. He has his own tractor, and his sons roam around on swanky motorcycles. Just sixty kilometers away lives Uday, a subsistence farmer who has no access to irrigation and plants mustard when rains are expected. He can barely feed his family of nine, let alone hope for a better future for them. Technology has totally evaded him.

Majid is in the 20% of farmers who drive agricultural growth in India, and Uday is one of the 80% who fall in the "marginal and small farmers" category. The latter segment is characterized by unproductive methods, very low income, and risky growing conditions, including no access to irrigation. Approximately 65% of the cropped area of India—where 83% of sorghum, 81% of pearl millet, 69% of cotton, 92% of pulses, and 90% of oilseeds are grown—is non-irrigated and depends entirely on erratic rains. About 40% of these farmers are women, though they do not have ownership rights to the land (GOI, 1999).

This paper looks at how Indian Agriculture has evolved over the past five decades into these two distinct farmer segments. Each needs different kinds of support, including suitable government policies, to help them move towards sustainable intensive agriculture. It is important for this divide to be bridged, as a modern nation cannot afford to be vertically disconnected so categorically.

The paper includes two case studies, one involving the affluent, high-technology farmer segment, and the other, the marginal and small farmer segment. The first case study is about a progressive, private-sector seed company, Proagro, which moved agricultural innovation to its next level after the Green Revolution and raised quality standards in the seed industry to international benchmarks. Its legacy is ongoing. The second study highlights a self-financed, technology-intensive NGO, the Institute of Rural Research and Development (IRRAD), which is working with marginal and small farmers through an "Integrated Sustainable Village Development" (ISVD) model in village clusters.

Both case studies are success stories and are replicable; therefore, they are in themselves recommendations to follow.

Notably, both these initiatives were led by the same expatriate, Suri Sehgal, a globally esteemed agricultural entrepreneur. It is suggested that governments of developing countries recognize the potential of expatriates and provide enabling environments for them to contribute to their native lands, as it is a critical mass of concerned and able citizens from elite sections of

developing countries who will have to put in motion the virtuous cycle that will eventually advance the less privileged among us.

TRANSFORMATION OF THE INDIAN AGRICULTURAL ECONOMY

GREEN REVOLUTION

When India became independent in 1947, it had only subsistence agriculture that depended on the vagaries of the monsoons. Famines were commonplace. **The world's worst recorded food disaster, the Bengal Famine, occurred in British-ruled India in 1943. An estimated four million people died of hunger that year alone in eastern India (which included today's Bangladesh).** In the 1960s, India had the humiliating label of "starving millions." There was even a well-known book, *Famine-1975! America's Decision: Who Will Survive?* (by Paddock and Paddock, 1967), in which the authors predicted that millions of Indians would die by 1975 and that the country had no hope whatsoever. However, India's prophesied demise did not happen. Instead, its food-grain stock grew from 50 million tonnes in the 1960s to over 110 million tonnes in the following decade, and the country has been self-sufficient in food grains ever since. This remarkable increase was brought about mainly by the irrigated farmers of Punjab, Haryana and western Uttar Pradesh, using only 22% of the total cultivated area in the country. Subsequently when two of the worst droughts of the century occurred in India in 1979 and 1987, the world did not take note because no food aid was needed.

This decisive turnaround in the mid-1960s occurred during a period of great crises in the country. Prime Minister Nehru died, India was at war with Pakistan, there were internal riots, and there was a precarious food situation because of acute drought from several consecutive years of poor monsoons. About 10 million tonnes of food grain had to be imported, which came largely from the US under the PL 480 (also known as "Food for Peace") program. Under this scheme, India could pay for the food grains in local currency, which later on would be used by USAID for development assistance in the country. Foreign aid was inconsistent, however, and often hindered by politics and other obstacles. At one point, India had stocks for only two weeks, with nothing in the transit pipeline (Swaminathan, 1993). Nonetheless, it is doubtful India would have overcome the food shortages without US assistance.

The story behind India's agricultural transformation of the 1960s had begun two decades earlier and a hemisphere away. In late 1940, traveling by car from Texas to Mexico City, former US Secretary of Agriculture Henry A. Wallace was appalled by the primitive agricultural methods and pitifully low yields of Mexican farmers. Shortly after his return to Washington, Wallace asked the Rockefeller Foundation to help Mexico modernize her agriculture. Within a few years, Mexico established a successful crop research program that would eventually become the International Center for Maize and Wheat Improvement (CIMMYT).

Dr. Norman Borlaug (later to receive the Nobel Prize), head of the wheat-breeding program at CIMMYT, sent samples of the wheat varieties he had bred in Mexico to Dr. M. S. Swaminathan in India, who planted these in a small observation plot at the Indian Institute of Agriculture. Dr. Swaminathan was so impressed with their performance that he invited Borlaug to India in March 1963. Subsequently, the Indian Minister of Agriculture, C. Subramanium, took the

politically bold step of importing 18,000 tonnes of the dwarf wheat strains from Mexico, the all-time largest single import of cereal seeds anywhere in the world. It was a risky decision, but it paid off—wheat yields in the farmers' fields more than doubled.
A similar revolution took place in rice cultivation. In 1960, the Ford and Rockefeller Foundations together established the International Rice Research Institute (IRRI) in the Philippines. The IR 8 variety of rice developed at IRRI was introduced in India in 1966, and soon rice yields also increased two- to threefold.

The PL 480 aid program of the 1960s, with help from the Rockefeller Foundation and USAID, led to a revamping of the entire Indian agricultural system. Newly established land-grant colleges, patterned after similar colleges in the US, helped to develop agricultural education and research in the country, including an extension service to provide advice to farmers. The foundation of the seed industry was laid in 1963 with the creation of the National Seeds Corporation, as it was felt that there was no point in developing new crop varieties without a mechanism for seed multiplication and distribution. The new varieties of wheat and rice coming from agricultural university research programs (especially Ludhiana and Pant Nagar, which enjoyed collaborations with Ohio State and Illinois State Universities, respectively) provided the engine for growth that culminated in India's Green Revolution.
The Green Revolution resulted in a record grain output of 131 million tonnes in 1978-79. By 1980, almost 75% of the total cropped area of wheat and 45% of rice were sown with high-yielding varieties. India was now one of the world's biggest agricultural producers, and it repaid all loans taken from the World Bank and its affiliates for the purpose of agricultural development. No other country in the world pursuing a Green Revolution recorded such a level of success.

Translating scientific achievement to the field was not easy. Since this high-input agriculture required irrigation, good drainage, fertilizers, and pest and disease control, it was a huge challenge for Indian administrators to organize the delivery system to make the necessary inputs available. Extensive infrastructural networks, price guarantees, credit for small farmers, and viable markets had to be put in place.
At the policy level, several developments took place to provide government oversight of the changing agricultural landscape, including the the Seeds Act of 1966 to regulate the growing seed industry (Gadwal 2003). During 1965-75, the private sector had stepped into the seed business to play a limited role, which was to produce and market the seeds of various crops developed by the government research laboratories. The Seeds Act required that seeds conform to a minimum stipulated level of physical and genetic purity and an assured percentage of germination, and it provided a system for seed quality control through independent State Seed Certification Agencies.

Many public-sector institutions were either set up or reorganized during the Green Revolution years. They were the National Seeds Corporation and State Seed Corporations to produce, process and market seeds of the new food crop varieties; the Food Corporation of India to provide market support by procuring food grain at the minimum support price and by storing and distributing food grain; the Central Warehousing Corporation to augment grain storage capacity; the Krishi Vigyan Kendra network for agricultural extension activities, including setting up demonstration farms across the country to disseminate information to farmers; the Department of Agricultural Research and Education, the nodal department for scientific and development activities and bilateral collaborations with other countries; and the National

Agricultural Research System, led by the Indian Council for Agricultural Research (ICAR). ICAR is the **top national** organization for sustainable agricultural growth in India, overseeing a vast network of agricultural research centers, institutes and universities. Over the years these institutions have produced a huge agricultural resource base.

POST GREEN REVOLUTION

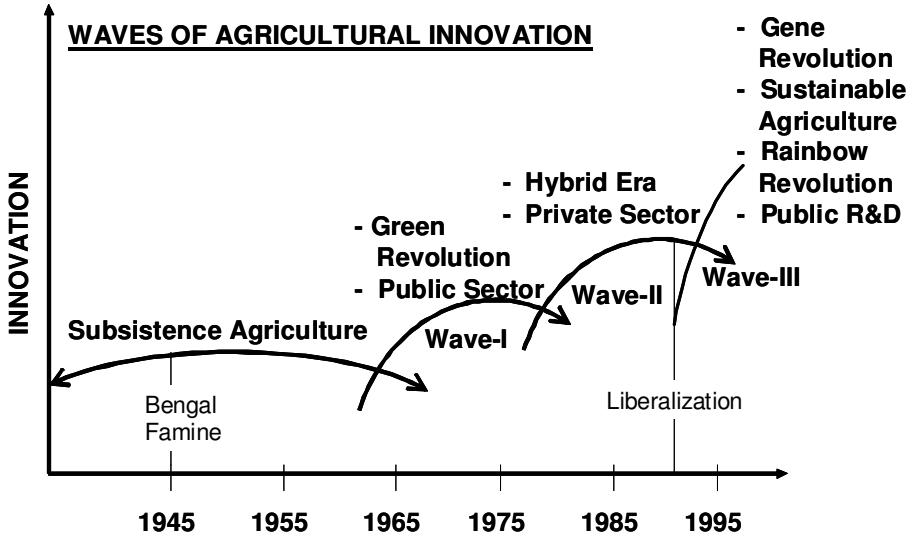

Figure 1

Figure 1 shows how agriculture in India has progressed over time. Initially there was only *subsistence agriculture,* which existed in India "forever." Seeds were recycled by the farmers year after year, without a scientific method, resulting in haphazard characteristics and low yields.

The subsequent waves of agricultural innovation were driven by demand, and a somewhat similar pattern is expected to occur in other developing countries. However, it is hoped that policy makers in these countries will take steps to jump directly to *Wave III* by encouraging the practice of "sustainable agriculture."

It is unfortunate that the beneficiaries of these advances have been just the 20% of Indian farmers who have the wherewithal to practice "intensive agriculture," while the marginal and small farmers have not been able to hook into this system. However, now in *Wave III*, India is making serious attempts to assist the marginal and small farmers, which will be further elaborated later in this paper.

Innovations are essential, as there is limited potential to expand lands for cultivation. Today only 17% of cultivable land produces 90% of the world's food crops. In March 2005, Norman Borlaug stated that "we will have to double the world food supply by 2050" with 85% of future growth in food production having to come from lands already in use.

Wave I in Figure 1, the Green Revolution, includes two categories: Scientific innovations, i.e., superior seed; and provisions for a nurturing environment for this seed to flourish on a large scale, such as irrigation, chemicals and other inputs, and sound agricultural policies. The nature of revolutions is that they are never final solutions, but rather place-holders till the next one

comes along. The mission of India's Green Revolution may have been a 15-year respite to give the country time to plan its long-term strategy, which is *sustainable agriculture*.

The Green Revolution produced superior self-pollinated varieties of only wheat and rice. This scenario now has evolved to include the development of not only superior varieties of many other crops, but also hybrids of various crops. Hybrids generally have greater potential to provide value addition than varieties. Hybrid seeds perform 100% only the first time they are planted, which is a win-win situation—the farmer makes large profits, using the value added hybrid seeds, and the private sector gets a return on investment. This has been depicted in Figure 1 as *Wave II*, the *Hybrid Era.*

The Green Revolution lost its luster when overall agricultural growth in India slowed in the 1990s. For the first time since the onset of the Green Revolution, annual growth in food grain output dropped to 1.7%, well below the 1.9% population growth of that period. The national and multinational corporations of the private sector entered the seed business in a big way in the 1990s, but they preferred to deal in non-cereal, high-value hybrid seeds for high-potential irrigated lands. Their contribution to India's agricultural productivity has been highly significant, but limited primarily to the upper 20% farming sector.

The current situation in agriculture (and allied sectors) in India is that it failed to achieve its targeted growth rate of 4% in 2007-08 and was not able to surpass 2.5%. However, India can achieve 4% growth if it focuses on the cluster of innovations depicted in *Wave III* of Figure 2: Sustainable agriculture, a "Rainbow Revolution," and the Gene Revolution. Like *Wave II, Wave III* could occur with the help of enabling policies of the government.

ENABLING GOVERNMENT POLICIES

After the Green Revolution, three important policy developments helped to foster private-sector participation in India's agricultural sector, which led to high growth that the public sector alone could not have brought about. First, in 1987, foreign companies were permitted to invest in the seed industry, thus encouraging investment from abroad. Second, the New Seed Policy of 1988 enabled companies to commercialize seed through self-certification/truthful labeling and did away with cumbersome government testing and registration processes. These policies allowed collaborations with companies abroad, particularly from Europe and the US.

The third, and most significant, development took place in 1991, when then finance minister Manmohan Singh took the first tentative steps to open up India's economy by allowing more foreign trade, investment, and competition . This was not a result of some considered national debate and dialogue, but of the fact that India at that time was so unappealing to foreign investors that it had almost run out of foreign currency. This policy identified seed production as a "high-priority industry." It greatly liberalized the import of seeds and encouraged multinational seed companies to enter the Indian market. In response, more than 24 companies invested substantially in R & D activities in India, and investments are expected to increase.

In spite of numerous economic reforms since 1991, the draconian "Essential Commodities Act, 1955" continues to allow the central and state governments to impose curbs on the stocking, movement, and marketing of agricultural commodities, deterring the farmers' right to free trade. The Economic Survey, 2004, asserted that with the opening up of the trade regime under the WTO, it was increasingly important for farmers to tap both domestic and export

opportunities, particularly in processed agricultural products, for which such domestic policy restrictions would need to be removed (Sud, 2009).

CASE STUDY OF PROAGRO: *CONTRIBUTION OF PRIVATE-SECTOR TECHNOLOGY COMPANIES*

Proagro Seed Company was established in 1988, right around the time the Government of India liberalized its seed policy. After this policy was announced, it took about 5-6 years for major global players to enter the Indian market. During this window of opportunity, Proagro grew rapidly to become one of the largest hybrid seed companies in India. ("Interviews", in Reference Section)

This was a period when the euphoria of the Green Revolution technology of improved self-pollinated varieties was calming down, and there was demand for value addition in many crops. Hybrid seed technology offered this. However, the global seed companies and development community felt it inadvisable to introduce hybrids to the developing world. They thought hybrids were technically difficult, the farmers' paying capacity was low, and there were bureaucratic hurdles to doing business.

Undeterred, Proagro quickly established itself as a leading hybrid-seed company in India by focusing on research and quality products. The commitment to quality and value addition paid off as Proagro hybrids were rapidly adopted by millions of farmers. The company had become a trendsetter in the field, and its success stimulated investment in the hybrid-seed business by many entrepreneurs and multinationals. This was the beginning of the research-based "Private-Sector Hybrid Era." For seed production, entire villages were contracted by Proagro and other companies to multiply hybrid seed in isolation to maintain its genetic purity. Such "seed villages" in Andhra Pradesh and Karnataka states saw incomes rise sharply.

Prior to 1990, the private-sector seed industry in India was in its embryonic stage, primarily multiplying varieties developed by the public-sector institutions rather than breeding its own. Today India's vibrant hybrid seed industry is valued at over 1.5 billion US dollars and is growing at 15% or more per year. Proagro was a leader in this transformation.

Proagro's proprietary, high-yielding maize hybrids have outyielded the widely grown public hybrids by annual averages of 24-31%. Its hybrid rice has had similar results. In all, the extra grain production from Proagro hybrids is sufficient to supply the annual food need for 101 million people for millet, 83 million people for maize, 22 million people for sorghum, and 3 million people for rice, at current per capita consumption rates in India. This additional grain represents several million dollars annual addition to India's GDP.

Proagro built agricultural capacities in the country by focusing on four key areas: (1) High-quality germplasm and plant breeding; (2) joint ventures to access new technology; (3) building a legacy of professionals; and (4) investing in specialized infrastructure.

ESTABLISHING WORLDWIDE NETWORKS

The success of a seed company depends to a large extent on the quality of its germplasm and the skill of its breeders. Proagro had dedicated breeders who liked to be in the nursery with their

plants. It met their resource needs and guided them to develop superior products. Proagro accessed germplasm from public institutions and Foundation Seed companies in the US. Good working relationships were established with Illinois Foundation Seed, Mike Brayton Seeds and Holden's seeds in the US; KWS of Germany; GeneX of Australia; and Eastern Hi-Bred and Nippon Biocapital of Japan. Linkages were also made with international crop specialists who regularly visited Proagro to review and help improve the research programs.

TECHNOLOGY JOINT VENTURES

In the 1990s, Proagro realized that biotechnology investments would lead to a higher level of productivity and value addition. Plant Genetic Systems (PGS) of Belgium had developed several technologies that offered potential for India, such as the barnase-barstar genetically engineered hybridization system, transgenic Bt technology for insect resistance, and herbicide resistance technologies. Proagro recognized that certain crops grown in India were good candidates for these technologies. For example, mustard seed for planting was available in India only as open-pollinated varieties (i.e., there were no hybrids), and the yields had leveled off with no hope of a breakthrough using classical breeding. Nationally this high-volume crop is of prime importance, as large parts of the country depend on it for cooking oil.

Proagro seized this opportunity and established a joint venture with PGS in 1993 to incorporate PGS's hybridization technology into the Indian mustard species and its Bt technology into vegetable seeds adapted to the Indian conditions (Mubashir, 1999). The Proagro-PGS joint venture established India's first private-sector, state-of-the-art biotechnology laboratory near Delhi, received government recognition for in-house R & D, and built scientific capacities in breeding with the transgenic system and molecular marker technology.

Proagro was the first company to apply to the Indian government for regulatory permits for GMOs, and its transgenic mustard became the first product to be approved for pre-release evaluations. Obtaining regulatory permits in India was very time consuming because the regulatory system was new and untested, but the company had a strategy to sustain operations and survive the gestation period until the transgenic products reached the commercialization phase. It established its market presence with a product mix of hybrids and open-pollinated lines of vegetables and mustard. Years later, after Proagro was acquired by Bayer, the joint venture eventually became Nunhems, which today is among the top two leading vegetable seed companies in India. Bayer at one point withdrew the transgenic mustard project because of the unduly long governmental approval process, but is now reviving it in today's more open regulatory environment.

Another joint venture, involving hybrid rice, resulted in similar success. In 1995, when hybrid rice germplasm became available in the pubic domain from IRRI, Proagro pursued a partnership with several leading Japanese companies. The resulting joint venture, Hybrid Rice International, was the first company in India totally dedicated to hybrid rice, including breeding, seed production and commercialization, and it soon became a market leader.

A LEGACY OF LEADERS

The management philosophy of Proagro was based on five Ps: People, Products, Pragmatism, Persistence, and Planning. Proagro strongly believed that:

- Good people can create miracles if properly supported;

- The seed business is a product-driven business, and the products must meet the highest standards of quality and performance;
- An organization needs to be pragmatic in its decision making and avoid "paralysis through analysis";
- Persistence is the key to getting job done;
- Good planning is critical to success.

Much of Proagro's success came from capturing the first-mover advantage. However, Proagro recognized that being first in the marketplace does not assure future performance. Following the philosophy outlined above, the company:

- Set value systems, emphasized a solution oriented approach, provided leadership advice, and had periodic reviews;
- Invested heavily in research as compared to other seed companies; (upto 20% of its net sales)
- Advocated international linkages to encourage interaction between its people and experts from abroad;
- Prepared for future growth by investing in infrastructure, often more than was immediately required, and hiring plenty of good people, including young researchers from the Indian Universities, expatriate professionals, and experienced senior breeders for each crop;
- Promoted a stable, productive, and positive work environment for its people by giving them job security, ample responsibility, and freedom to operate; building mutual trust between management and employees, including giving credit where due; and involving families of its staff in various leisure activities outside the workplace, which encouraged personal rapport;
- Emphasized good planning, which was implemented through interdepartmental decision making and common reviews. The synergy among research, production and marketing groups was instrumental in forwarding the right products into the market and fostering a strong team spirit.

Two decades later, former Proagro employees now lead half a dozen seed companies in India. In interviews, they acknowledge that they became "good seedsmen" at Proagro and recall the extraordinary momentum, team morale, and energy at Proagro. They say that in their current organizations, they are replicating the Proagro model, both in terms of operational design and work culture.

SPECIALIZED INFRASTRUCTURE

In addition to investing in excellent people and technology, Proagro built state-of-the-art facilities.

In 1988, when the telecommunication industry in India was still poorly developed and it was a challenge to make even a long-distance phone call, the company established an IT department

and computerized its offices and operations. For the first time in the seed industry, an automated process was developed to track the movement of seeds across functions and locations. This contributed to excellent quality control and monitoring.

Proagro's image as a "total quality" company with superior products was reinforced by constructing an ultra-modern seed-processing plant at Toopran, Andhra Pradesh. Built in 1993-95, it was the largest plant in Asia at the time. Prior to this, the Indian seed industry did not appreciate seed processing (cleaning, treating) as a factor that improved seed quality, and it gave little importance to warehouse maintenance. For example, the Toopran plant, which was built by in-house engineers, utilized modern techniques like vacuum dewatering to obtain strong and smooth concrete flooring so that the seed would not stick to it. This attention to detail and emphasis on best practices separated Proagro from its competition.

CASE STUDY OF IRRAD: *MODEL FOR CLUSTER-BASED INTERVENTION FOR MARGINAL AND SMALL FARMERS*

Grassroots actions are required for the welfare of the marginal and small farmer, and NGOs have a key role in facilitating this. The Institute of Rural Research and Development (IRRAD) is an example of such an NGO. IRRAD operates primarily in Mewat, a district in Haryana state comprising about one million people, and has its headquarters in Gurgaon.

When IRRAD began its work in 1999, its team had rather naively considered focusing only on agricultural improvements and population issues. However, after talking to villagers, it quickly realized that the farmers and their families faced myriad problems. First and foremost, they were desperate for water. In a typical village, very few wells still had freshwater; the rest had run dry or turned brackish. The schools had no water, toilets or benches, teachers were routinely absent, and the government's midday meal was being served under filthy conditions. In some villages the female literacy was only 2%. Electricity was erratic and available for a few hours at most, causing a whoop of joy across the village whenever it came. In one typical village, only two out of 200 households had toilets. The average woman had seven children with hardly any healthcare facilities…and the list goes on and on.

IRRAD then understood that the life of a marginal and small farmer is embroiled in numerous difficulties beyond his farm. Every issue was linked in a complex manner to another issue, and the approach had to be holistic. They sat down with villagers to discuss what could be done. IRRAD concluded that if it could make a difference in this region, where the people are very poor and social indices are among the lowest in the country, the lessons could be adapted elsewhere in the country.

Through its grassroots action over a period of four years, IRRAD developed the "Integrated, Sustainable Village Development" (ISVD) model. The critical element of the model is that all implementation is by the local people, who are trained by IRRAD. The model has five programs:

(1) Income enhancement (agriculture and vocational training)

(2) Water management (watershed, roof-water harvesting, check dams, recharge wells)

(3) Life skills education (informal instruction for adolescent girls and improvements in village schools)

(4) Rural health (reproductive and child health implemented through trained village women, sanitation, linkages with health service centers. Family planning information is provided and access to contraception methods is facilitated.)

(5) Alternative energy (solar street lights).

In addition to these programs, IRRAD provides training in rural governance to groups of Sarpanchs (village council leaders) and other interested villagers on an ongoing basis. These rural governance trainees have seen quick success in using the Right to Information Act in combating corruption, opacity, and arbitrariness. Some of the other assignments given to the trainees include procuring and systematizing identity cards for the villagers for various government schemes, activating the Village Education Committee, putting food ration schemes in place (for schools, pregnant women, and people below the poverty line), and accessing the National Rural Employment Guarantee Act for village development. On the public distribution of food grain, one resident of the village of Notki remarked, "Thanks to trainee interventions, for the first time all card holders are receiving their fair share of rations."

One of the key constraints in development initiatives in the villages was the lack of a proper gathering place to act as a hub for information and training. To address this need, IRRAD built a community center on the outskirts of Ghagus village that caters to a cluster of neighboring villages and provides a platform for village-level organizations to hold their activities.

Partnerships are the name of the game. IRRAD has built local-level partnerships among the stakeholders—the community, the government, other NGOs, and the private sector—as each has competencies the others do not.

Nowadays some private-sector companies are coming forward with genuine corporate-social-responsibility initiatives for farmers that they implement with the help of NGOs. An example is the partnership between IRRAD and the fertilizer company Mosaic, whereby Mosaic funds demonstrations in farmers' fields to show how essential micronutrients dramatically improve productivity. This is a win-win model: Mosaic, which normally would not put effort in an area like Mewat because of limited business potential, gains new customers, while the farmers of Mewat for the first time have their degraded lands tested for soil health and gain much-needed access to authentic micronutrients.

To date IRRAD has implemented its ISVD model in a cluster of 20 villages to ensure its replicability and scalability. In addition, IRRAD provides training on different aspects of the ISVD model to other NGOs on request, conducts research on various aspects of rural development including impact assessment, and implements adapted versions of ISVD in other regions as per funded requests. For its efforts to implement the United Nations Millennium Development Goals, IRRAD has been granted consultative status by the UN Economic and Social Council and is a member of the Clinton Global Initiative.

IRRAD is striving to become a rural-research think tank capable of influencing policy makers and galvanizing grassroots action. Some worthwhile issues to bring to the attention of policy makers on behalf of marginal and small farmers are listed in Table 1, which shows how several

government policies over the last four decades have inadvertently favored irrigated agriculture and adversely impacted rainfed agriculture. The huge subsidies on agricultural inputs and food have benefited the farmers with access to irrigation, but rendered the farmers without access to irrigation uncompetitive. The latter were bypassed by the Green Revolution, and the distribution of income between farmers with irrigation and those without has become more unequal and adverse.

Table 1

Adverse Effects of Policies on Rainfed Agriculture and Suggestions for Correcting the Policy Bias

Policy	Intended Impact	Adverse Consequence	How to Correct the Policy Bias
Minimum support prices backed by selective procurement (rice and wheat only)	Encourage farmers to produce more without the fear of price risk	Prices of rainfed crops fell relative to those of rice and wheat	Extend procurement support to rainfed crops
Supply of subsidized wheat and rice in the Public Distribution System (PDS)	Improve the access of poor consumers to food grains	Distortion of price ratios and hastening of substitution of coarse grains by rice and wheat	Replace PDS with food stamps
Subsidies for key inputs such as fertilizers, irrigation water, and power	Encourage farmers to adopt improved technologies and to produce more	Made rainfed farming uncompetitive due to higher subsidies for irrigated farms	Target more investments and subsidies to rainfed areas and crops
Crop loan-insurance schemes	Protect farmers from shortfalls in income	Coverage only for irrigated farms due to higher access to credit	Introduce subsidized rainfall insurance schemes for rainfed areas

Source: Rao, 2006.

Based on its experience in the field, IRRAD recommends the following actions to improve the economy of marginal and small farmers: Make water available; organize farmers into associations; inform them about best practices and the unsustainable aspects of intensive agriculture; provide instruction through on-farm demonstrations; set up farmer information centers; and promote linkages to government schemes.

THIRST FOR WATER

Poverty and irrigation are directly linked. While the incidence of poverty in India is as high as 69% in districts with less than 10% cropped area under irrigation, it is about 26% in districts where more than 50% of cropped area is irrigated, and just 10% in areas of Punjab and Haryana

with over 70% of cropped area under irrigation (World Bank, 1991). The per capita availability of water in India is significantly lower than the world average and has been declining rapidly due to the increase in population (Table 2).

There are three types of irrigation: Canals from dams or rivers, underground water, and tanks of harvested rainwater. One-fifth of Indian farmers benefit from canal irrigation, which is the least expensive. In the next few years, the largest increase in irrigated area in the world is expected in India, but the annual increase in canal-irrigated areas is falling rapidly. This is due mostly to the deterioration of existing canal systems from lack of proper maintenance. Furthermore, canal irrigation cannot reach everywhere. IRRAD, based on its experience in the villages of Mewat, recommends that the marginal and small farmer follow local surface and groundwater management.

In the case of rainfed agriculture, it is possible to significantly increase the current 1% productivity growth (World Bank, 1991) through better water-harvesting techniques and in situ conservation of soil moisture. This would reduce susceptibility to drought periods during the rainy season as well as extend the crop growing period. Reviving traditional water management institutions and infrastructure are highly viable options as they involve low investments and are easily replicable at the farm level (IRRAD Annual Report 2008/09).

To date about 45 million hectares in India have been covered in some way under watershed programs, while about 75 million hectares remain to be covered. This should be an immediate priority (GOI, 2008).

Table 2 Vanishing Water: Per Capita Water Availability in India

Year	Population (million)	Per capita water (cubic meters)
1951	361	5,177
1955	395	4,732
1991	846	2,209
2001	1,027	1,820
2025 (projected)	1,394	1,341
2050 (projected)	1,640	1,140

Source: ICAR, Handbook of Indian Agriculture

FARMER ASSOCIATIONS

The marginal and small farmers of India belong to the unorganized sector. Organizing them into associations can provide them with many benefits, such as economies of scale, sharing of implements and information, market linkages, and access to authentic inputs, credit, and insurance.

There are numerous models for organizing small farmers (GOI, 2008). It has been IRRAD's experience that a nascent association requires sufficiently long hand-holding prior to it becoming self-sustaining, as many conflicts can arise due to village politics and incompatibilities with market representatives.

On-Farm Demonstrations

On-farm demonstrations are the best way to educate farmers because they illustrate very clearly the cost-benefit ratios of different farming alternatives. However, farmers tend to be cautious and prefer to follow others rather than be the first to try out new things, even after seeing demonstrations. IRRAD, the government's Kisan Vigyan Kendras, and other organizations have to work persistently over several years to get a critical mass of farmers to adopt a new practice. Most areas of India would benefit from the introduction of farming improvements such as the addition of micronutrients, crop diversification, intercropping, stalking of vines, raised bed cultivation, and drip irrigation.

Farmer Information Centers

Farmers need reliable access to information. In Mewat, farmers would often travel miles, going from pillar to post based on rumors, trying to find knowledgeable people to advise them on their crop problems. Some assistance is available from the private sector, as Indian companies and multinationals are now providing highly professional extension services due to tougher competition. In regions like Mewat, however, there is minimal interest by the private sector, and the practices promoted by these companies are often incompatible with marginal and small farms.

The community centers built by IRRAD fill this need, acting as information centers and hosting crop demonstrations. In addition, the government's Krishi Vigyan Kendra network has a powerful mandate to disseminate knowledge and technology through farmer training, farmer-scientist interaction, print media, and so on. However, as with most grassroots government services, this agricultural extension service is not effective enough and is vastly underutilized. IRRAD is rebuilding bonds of trust between the community and the public services by organizing advocacy meetings between them. One of IRRAD's continuing challenges is to alter the community's mindset from "It's the government's job to develop us" to "We must take our development in our own hands and cooperatively work with the government."

Linkages to Government Schemes

Credit is the most essential ingredient to kick-start the virtuous cycle for small farmers.

Of the total credit needs of farmers, commercial banks meet only 15-20% and the cooperative credit institutions cover about 25-30%, while the majority of farmers rely on traditional moneylenders. The moneylenders charge interest rates in excess of 25%, sometimes going up to 50%, often leading to chronic indebtedness and, in some cases, to desperation and suicide.

Most of the government schemes for the marginal and small farmers involve finances, i.e., credit, insurance, and debt relief. However, most farmers do not know how to access these programs. Those who do have some access to institutional credit are subjected to credit rationing by the institutions due to perceived high risks. Hence they do not get much coverage under the National Agricultural Insurance Scheme, which focuses primarily on crop-loan insurance. Well designed and appropriately subsidized rainfall insurance products can entice rainfed farmers to buy the policies and get adequate insurance coverage (Rao, 2006).

CONCLUSION

The modernization of Indian agriculture in the last half century involved high-yielding varieties of food crops, hybrids, and genetically modified cotton and vegetables. From a land beset by famine, India has become a leading agricultural producer. Governmental will, public-sector R&D, and vibrancy in the private sector stimulated this remarkable change. Unfortunately, modern agriculture has reached only those 20% of Indian farmers who have had access to irrigation and benefited from land reforms.

Thus Indian agriculture has a split personality—20% of farmers are affluent and technologically savvy, while and 80% are "marginal and small farmers" living in dire poverty and practicing unproductive agriculture. Though it is the latter who elect the governments, being the largest electoral constituency, the government's funded efforts and policy initiatives mostly benefit the "organized agricultural economy" while leaving the "subsistence economy" behind.

The marginal and small farmers face problems that are complex and interrelated, calling for a holistic approach rather than just some limited agriculture interventions. Many of them are tenant farmers who cannot borrow from banks, forcing them to take loans from village moneylenders and live in permanent debt. Assistance for them is needed through interventions at the village level, which is highly suited to efforts by the non-profit sector in collaboration with the local government.

Following are some of the recommendations for both affluent and marginal farmers.

- A holistic approach is required to address the many needs of subsistence farmers, including watershed development programs to ensure freshwater supplies, access to effective government credit schemes, healthcare, education, and civic facilities. Collaborative efforts like farmers associations and cluster-based support mechanisms go a long way towards achieving these goals.
- Remove domestic policy restrictions, especially pertaining to the Essential Commodities Act, 1955, so that well-to-do farmers can tap both the domestic and export markets in this post-WTO regime.
- Enhance funding for public-sector research.
- Other countries should follow India's lead and not patent genetic resources, but protect them through the Plant Variety Protection legislation.
- The Indian diaspora can contribute significantly to the effort of rural development, and the Ministry of Overseas Indian Affairs should take proactive steps to facilitate this.

The biggest challenge is to induce hope in the marginal and small farmers, who have only experienced helplessness over many generations. The best way to ignite enthusiasm is through demonstrations and role models, both from outside and within the communities. Simple events like organizing a female professor's talk with adolescent village girls, or having Sarpanchs from neighboring villages visit IRRAD's demonstration village in Notki, have had remarkable effects.

The role of NGOs is to promote confidence in the people and sustainability in the interventions, in a period of a few years. However, this has to become a large movement to affect the 600

million villagers who need and deserve this kind of commitment. Only then will India realize her dream of becoming a developed country.

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