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Pakistan's Food and Agriculture Systems

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Under this provision, Nathan Associates conducted three in-depth sector analyses as a follow-on to the Economic Performance Assessment for Pakistan that Nathan Associates completed in September 2007. This report is a compilation of these studies. The authors are Timothy Ekin (team leader) and Farrukh Baig Mirza from JE Austin for value chains, Anne Kuriakose from JE Austin for the irrigation desk study, and Syed A. Husaini and Thomas Hutcheson from Nathan Associates for agricultural policy issues, Dr. Husaini also drafted the background chapter 2 on the agricultural sector.

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Acronyms

AKRSP	Aga Khan Rural Support Program
ADB	Asian Development Bank
AARI	Ayub Agricultural Research Institute
AEZ	agricultural economic zones
BOT	build, operate, and transfer
CBO	community based organizations
CAS	Country Analytic Support Project
EGAT	Economic Growth, Agriculture and Trade (USAID bureau)
FMAP	Feed Millers Association of Pakistan
FFS	Farmer Field Schools
GDP	Gross Domestic Product
GMV	genetically modified varieties
GMOs	genetically modified organisms
GIS	geographic information systems
HACCP	Hazard Analysis and Critical Control Point
IBIS	Indus Basin Irrigation System
IWMI	International Water Management Institute
IMT	management transfer
MFI	microfinance institution
MSP	minimum support price
MINFAL	Ministry of Food, Agriculture and Livestock
NARS	National Agriculture Research System
NFDC	National Fertilizer Development Centre
NGO	nongovernmental organization
NRSP	National Rural Support Program
NOAA	National Oceanic and Atmospheric Administration
OH&S	Occupational Heath and Safety
PPA	Pakistan Poultry Association Punjab Zone
PPAF	Pakistan Poverty Alleviation Fund
PASSCO	Pakistan Storage and Supplies Corporation
PIDs	Provincial Irrigation Departments
PIDA	Provincial Irrigation and Drainage Authorities
PPCB	Punjab Provincial Co-operative Bank
PSC	Punjab Seed Corporation
REAP	Rice Exporters Association of Pakistan

SCARP	Salinity Control and Reclamation Projects
SCAP	Seed Company Association of Pakistan
TCP	Trading Corporation of Pakistan
WAPDA	Water and Power Development Authority
WUA	Water User Association
ZTBL	Zarai Taraqiati Bank Limited

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Executive Summary

National and global economic changes—inflationary oil prices and skyrocketing food prices—and national political uncertainty, compounded by deterioration in law and order present serious challenges for Pakistan's economy and its agricultural sector in particular. Growth has slowed, inflation has increased, and the trade deficit has widened. Stagnant wheat production and an unprecedented level of informal wheat trade to neighboring countries have made the food supply insecure. Pakistan's traditional, subsistence agriculture is becoming commercial, albeit slowly. Directly and indirectly, the sector is the main source of income for about 66 percent of the rural population and is key to poverty reduction and national food security. In this context, how can Pakistan raise the value of its production of food staples and remove impediments to food marketing and market access systems? Here we offer answers to these questions by recommending possible solutions to specific problems and systemic issues, as well as recommendations for USAID interventions.

AGRICULTURE SECTOR

Pakistan's agriculture sector consists of four subsectors: food and fiber crops, horticulture and orchards, livestock and dairy, fisheries, and forestry. From the 1960s to the late 1980s sector output grew, thanks to high yielding and fertilizer responsive crops and expansion of the land base and irrigation water supply, but little was done to reduce post-harvest losses or add value. Since 1990 farmers have put more land under food crops, oilseed, orchards, and horticulture at the expense of "other" crops. But rising food crop yields—attributable to use of fertilizer and pesticides—are, on average, still lower than elsewhere in the region and much lower than yields in developed countries. Likewise, Pakistan is the world's fifth largest producer of milk, but the average yield per animal is very low and very little is processed hygienically. About 80 percent of the recent rise in value-added has come from livestock, with the livestock and dairy subsectors now contributing about half of agriculture's share of GDP. Meanwhile, total factor productivity is stagnant.

Technical change and value addition have been slow for a number of reasons: low investment in research and development, in developing or disseminating higher production packages, in maintaining an effective agricultural education and extension system, and in maintaining physical infrastructure. Problems are compounded by resource degradation and the dominance of the public sector in agricultural trade and price controls. What can be done to effect positive change in the sector as a whole?

Facilitate formulation and enforcement of a policy on minimum economic farm size based on digitized cadastral maps and an electronic land titling system that is easy for farmers and banks to use. Out of 34.5 million hectares of arable land in Pakistan, about 23.4 million are cultivated. Farm size distribution is skewed with many small, owner-operated plots and a few very large holdings. With most farms less than the economic landholding size of 5 hectares ha. there is little investment in land development, farm structures, and machinery. The antiquated land titling system discourages efficient land markets, investment in land, and the use of land as collateral for formal credit.

Pass and enforce laws to check the mushrooming growth of tube wells and the high rate of abstraction. About 85 percent of Pakistan's cropped area is irrigated. Tube wells are increasingly used but groundwater abstraction has not risen commensurate with the number of wells, indicating abstraction in excess of recharge and leading to saline encroachment into fresh groundwater aquifers.

Enable fair competition in the agricultural marketing system at all levels. The provincial food departments and a parastatal, the Pakistan Storage and Supplies Corporation, procure wheat up to a target amount, after which the private sector may procure wheat. Similarly, the Trading Corporation of Pakistan, under the federal Ministry of Commerce, imports wheat, fertilizers, and occasionally other food commodities. The factor and product markets are linked at the retail/wholesale stage. A commission agent (*arhti*) supplies input as a dealer and wholesaler, purchases produce, and supplies regular customers inputs on credit, whether for production or consumption. Farmers pay a very high implicit interest rate because of risk and lack of competition.

Ensure private seed companies a level playing field and access to basic seed and plant materials developed by public researchers. Farmers retain seed for cereals from previous crops or purchase them from other farmers or wholesalers/commission agents. Wholesalers provide seed from previous crops or by way of national and multinational seed companies, as well as the public sector provincial seed corporation. About 600 registered private seed companies import or produce oilseed and vegetable seeds, while multinationals deal mainly in hybrids. Only provincial seed corporations are permitted to multiply improved cultivars released by public researchers, and handle their processing and sale to farmers. A national company has started producing and marketing hybrid paddy seed. Breeder's rights need to be protected and access to private seed companies should not be restricted. Seed corporations should operate as commercial entities and not be subsidized. A Breeder's Act, now being considered, would ensure breeders' rights and private sector access to the new seeds.

Target fertilizer subsidies. The private sector produces and sells fertilizer. The government imports fertilizer to fill any supply gaps and subsidizes all purchases to encourage balanced usage. The main problems with fertilizers are timely availability and adulteration. The subsidy should target small and marginal farmers, not all purchasers.

Disseminate information on safe pesticide use. Except for aerial sprays and locust control measures, the public sector is not involved in pesticide formulation, manufacture, or trade.

Indiscriminate use of pesticides is creating health and environmental hazards. Provincial extension departments need to inform farmers of safe methods of pesticide application.

Explore opportunities for integrating farmers, supermarkets, processors, and exporters into value chains. Contract farming was recently introduced in Pakistan on a limited scale. The main producers of maize-based products negotiate pre-sowing contracts with growers. Fruit processors and exporters are bypassing commission agents to enter into direct agreements with orchard owners for supply of given quantity of fruits at a negotiated price. Two cash and carry companies have started buying vegetables and fruits from growers.

Improve governance to expand private sector's role in the sector. Poor governance, especially rent seeking, is hampering the role of private sector in agriculture. Contract enforcement is very weak and investors bear great risks (e.g., in linking credit with input provision and output purchase). The obsolete titling system makes credit disbursement against collateral or contract farming arrangements nearly impossible. Moreover, the mechanism for settling disputes over property, land rights, or tenancy is cumbersome, costly, and usually not favorable to the small and vulnerable. The justice system as a whole needs reform to make services accountable and to empower the disadvantaged, particularly women. Though women contribute to most farming operations, that contribution is not accounted for. Local tradition deprives women of the right to inherit property, or, if they do own property, to manage it or earn money from it.

IRRIGATION

Pakistan's surface and groundwater sources are at their limit and the country is facing severe water stress. One of the world's most arid countries, Pakistan has the world's largest contiguous irrigated area in the form of the Indus Basin Irrigation System. The country's once huge groundwater reserves are threatened by salinization and water logging caused by intensive irrigation. This, in turn, is threatening the agriculture sector in Punjab and Sindh. More than half the farmers in Sindh may be keeping part of their land fallow because water is scarce. In Balochistan, drought-stricken since 1997, the provincial government subsidizes groundwater pumping through low electricity tariffs and farmers pump water from hundreds of meters depth. Because tariffs do not reflect the scarcity value of the resource water is not used efficiently. Multiple uses, particularly of canal irrigation water, are not considered; and poor farming practices—such as failure to use canal lining or water-sparing innovations—squander water. Aging infrastructure requires massive investment to be upgraded; dwindling capacity to manage the irrigation system must be revitalized; and the government must enforce water rights. Looming water shortages threaten Pakistan's economy and polity. The need for more storage capacity and efficient water management and allocation is urgent.

Donors supporting irrigation in Pakistan include the World Bank, Asian Development Bank, the UK Department for International Development, and The Netherlands. In 2008, the World Bank approved a $38 million grant to Pakistan to build capacity and to support federal institutions in water resources planning and management; hydropower planning; the upgrading of modeling and management systems and databases; and in conducting a sediment study for the Indus system.

Work will include studies on water resources regulation, policy, and planning; stakeholder benefit-sharing; action plans for asset development, ownership, and operation including potential interprovincial assets, public-private partnerships; institutional regimes for benefit sharing across administrative levels; lessons learned on resettlement; environmental and social assessments at basin level; climate change impacts on Indus hydrology, water availability and infrastructure development; studies on water use productivity and irrigation efficiency; and knowledge sharing on groundwater and conjunctive use. Training in system planning and management, mainly through the Water and Power Development Authority, will cover GIS and modeling efforts, including optimization models for the basin. What else can be done?

National agricultural water policy covers water law, rights, pricing, and allocation; user participation; subsidy policy; and asset and management transfer of infrastructure as in Irrigation Management Transfer (IMT). Recent reforms have emphasized economic valuation of water resources, though valuation has proved difficult. For ***national level improvements***, we offer three broad recommendations:

- Assemble a panel of stakeholders to consider reforms in governance and regulation of water management, including water entitlements and administration from the interprovincial level to the user level.
- Generate awareness of the need to improve basin modeling and system design capacity to address flow variability, and invest in new infrastructure.
- Develop capacity for river basin management, basin modeling, and socioeconomic analysis of water basin planning by supporting graduate training, secondments, study tours, etc.

The regulatory framework for the water sector should address the relationship of groundwater entitlements to surface water rights and actual surface water deliveries by involving users in groundwater monitoring and voluntary self-regulation. Groundwater management is inextricably linked to formal and informal water allocation and rights regimes. Hence one must consider not only regulations and policy, but also informal entitlements given the fact of overlapping rights regimes. In addition, irrigation services are delivered mainly through large public enterprises operating with little oversight by or input from users. Ensuring accountability, transparency, and financial sustainability will require that new community and user associations enter the sector, as well as small and large private operators, using clear entitlements, benchmarking, and transparent rules for operation. Some decentralization has already taken place; Punjab and Sindh have undertaken reforms to decentralize irrigation management and improve user participation, including clear entitlements.

One type of new user association could be “multiple-use water organizations.” Water agencies give irrigation priority but poor households use and re-use water from multiple sources for not only irrigation but also drinking, livestock, industrial applications, sanitation, and recreation. Urbanization requires reallocating water from agriculture to industry, energy, and urban consumption. Despite the evidence of integration of water uses at the local level, there are few “multiple-use water organizations.”

Plenty of donors are intervening directly to remedy waterlogging and salinity, so USAID should do no more than monitor those issues. Our general recommendations for other ***local or provincial interventions*** are as follows:

- Help make irrigation services more competitive, accountable, and efficient by supporting continued development of (water users associations) WUAs below the distributary level and by supporting public-private partnerships at the canal command level.
- Investigate institutional approaches to groundwater management and develop a program for sustainable management
- Subsidize technological interventions, such as drip irrigation or microhydel investments, and complement with focused extension efforts and development of an integrated value chain and business development services.

Investing in irrigation reduces poverty by increasing food output, raising demand for agricultural labor, and generating higher incomes than rain-fed agriculture alone—especially when land ownership is less stratified. The effect of investment on poverty depends largely on how water availability affects demand for agricultural labor by increasing agricultural intensity and the area under cultivation. Further, high-value crops such as spices, cotton, and groundnut, produce more employment per drop of water than traditional crops. Women benefit directly through crop-based income and indirectly through irrigation-driven agricultural employment that reduces rural out-migration. One may quantify the indirect multiplier effects on women's contribution to economies at different scales through, for example, gender-disaggregated input-output or social accounting matrices, or CGE models.

To be successful, such initiatives must also support the development of local suppliers, taking into account the production and distribution of low-cost equipment, market outlets, individual farmers' technical knowledge and management capacity, and the organizational capacity of WUAs. Projects to increase horticultural production and the production of other nontraditional crops should also define target groups in a transparent way, and consider the sex-disaggregated labor impacts of increased production, processing, and marketing in local areas. Feasibility studies should estimate the number and proportion of farms in the command area that will be lifted above the poverty line through projects.

Irrigation managers have for some time considered spatial inequity in relation to physical structure, but inequitable access due to tenancy, gender, or other socioeconomic factors is less frequently considered. WUAs are helping to resolve water distribution issues for upstream and downstream users, but inequitable access due to social status is less easily overcome. In Punjab, a tenant's right to join a WUA depends on the tenancy. Permanent tenants long associated with a certain plot of land are often delegated a right to membership, though this remains the prerogative of the landlord and is thus vulnerable to manipulation.

Pakistan's small-scale and traditional irrigation systems range from spring-fed and shallow-well systems, to elaborate groundwater conveyance systems such as the karezes of Balochistan, as well as water harvesting systems and small-scale storage for kitchen gardens and the like.

Participatory approaches to drainage investments have also worked well and sorely need additional support in Pakistan.

By delivering water directly to plant roots, drip irrigation can double average yields. The PPAF has a community funding provision for drip irrigation kits in water-deficit areas, mainly for horticultural crops, and requires a community contribution of 20 percent to enhance local ownership. For centuries, communities in the hilly areas of Pakistan have built and managed small irrigation channels fed by mountain streams. Organizations such as the Aga Khan Rural Support Program (AKRSP) have scaled up these channels through microhydel schemes financed mainly by grants, with some community contribution; total costs per scheme average about US$$10,600 or $150 per household served. Microhydels are used for lighting for heating and cooking, agricultural processing, small business, and even community washing stations and low-wattage water heating for off-peak use. The power generated by the microhydels is compatible with irrigation since only the head and not the total water volume is reduced so the irrigation command area does not have to be reduced. AKRSP's simple, cost-effective approach can be replicated easily.

In sum, to improve small-scale irrigation specifically, USAID should consider supporting, promoting, or aiming for

- Irrigation management transfer reforms.
- The bundling of water, agricultural extension, and financial services.
- Pilot initiatives for private sector financing of small-scale irrigation.
- Multiple uses of irrigation water.
- Parallel development of water and small-scale energy, including micro hydels for electrification (including agricultural processing) and pump set operation in hilly areas.
- Improved equity and pro-poor outcomes for women and land-poor men.
- Mainstreaming groundwater management concerns in the IWRM, particularly in Balochistan, Sindh, and Punjab.
- Participatory design to focus on environmental issues, such as soil and water quality.
- Research on role of small towns in rural areas and implications for water management

VALUE CHAINS

Pakistan's key food crops are wheat, rice, maize, oilseeds, and sugar. Wheat, essential to food security especially in urban areas, has little value added until it is milled. Commercial growers and researchers have greatly different wheat yields and the incidence of leaf and stem rust is on the rise. Crops are not diversified and no research has been done on other related crops, such as triticale. Confusing policies hamper private sector crop development, yet Pakistan could well become a wheat exporter as most of its commercial crop is irrigated. Rice is significant in the Pakistani diet and Basmati and coarse rices are profitably exported. Pakistan's public agricultural research system has not yet produced hybrid rice varieties. Maize has good growth potential and a ready market in the feed milling industry. If, as reported, the main crop production area is being

irrigated with “mined” non-replenishable water the government may need to encourage production where water does not have to be mined.

Pakistan consumes around 3.0 million MT of edible oil, 70 percent of which is imported, and demand is rising. The country could perhaps be more self-sufficient in edible oil. Domestic edible oil is mainly from cotton seed oil, and the rest from sunflower and canola. Soybean is able to supply edible oil and protein for feed mill rations, although this crop is in decline and as it is a non-hybrid, self pollinated crop this situation is not expected to be reversed until Pakistan passes plant breeders rights and has an effective rule of law. Meanwhile, the growing sugarcane subsector competes for land and water with wheat and oilseeds. Historically, costs of producing sugar in Pakistan have been much higher than the cost of importing it because of tariffs and a variable import quota; at today’s prices the cost disadvantage is less.

Other important subsectors are horticulture and livestock. Horticulture is profitably exported, but little value is added and most products are exported ‘fresh’ and often are of very low or inconsistent quality. Unhealthy practices deter innovation and investment. For example, land owners sell mango crops prior to harvest to traders who then manage the produce from harvest and trade to domestic or export markets, resulting in a lack of transparency, and poor quality assurance across the supply chain. This implies that many land owners are not interested in growing activities, perhaps because many inherited land and don’t appreciate its value. The livestock sector is not much advanced with the possible exception of the dairy industry. Value adding, genuine quality assurance, product traceability, brand recognition or other supply chain strengthening approaches are minimal.

Agricultural inputs include seed, fertilizer, and agricultural mechanization. Most hybrid seed in Pakistan is imported. Local seed is often of low quality yet Pakistan has no AEZ restrictions to be self sufficient and export seed. Public sector research is increasingly unable to deliver new varieties commercially acceptable to growers. Parastatal and government participation in the seed market complicates market signals as their poor quality seed is sold below real costs and without profit. Private sector actors are reluctant to research and develop new products as Pakistan does not protect breeders’ rights. New products must follow a restrictive pre-release testing phase, while public sector plant quarantine and seed certifications are largely ineffective. Few entities participate in fertilizer and few products are suited to the range of AEZ and crops. This input area could benefit from private sector led commercial agronomy services promoting tailor made solutions. Participants include subsidiaries of multinationals who generally market higher quality products. National and family owned enterprises formulate off-patent and sometimes harmful products of varying quality. Regulatory measures are federal and provincial.

Agricultural mechanization—ranging from land preparation, growing, harvest and post harvest—is not advanced in Pakistan’s commercial agriculture sector. For example, some maize is hand shelled or separated from cobs by laborers flailing with sticks. And disc ploughs still common in Pakistan have been shown to create hard pan; farmers should use other cultivation options or minimal tillage options.

Some well established private sector trade groups collect, transport, store, and assemble rural produce, and trade in and outside the country. They tend to be simple and focused on urban areas. Overall, the agriculture supply and value chains are weak—lacking innovation; diversification in cropping, production, and enterprise selection; trading sophistication; value addition at the cottage level; and new products, packing, and marketing.

The enabling environment for value chain development encompasses rural infrastructure, finance and credit, land marketability, asset valuation; and national sector coordination. The many weaknesses in the rural infrastructure—communications transport, postharvest processing, bulk handling or specialized product movement facilities—are compounded by an uncertain business environment. Commercial growers and agribusiness, for example, have few genuine or innovative opportunities for acquiring finance and insurance. Rural credit options exist, but growers must have a land title deed before banks will lend. A land title is a prerequisite for a bank account, and banks tend to lend only to those with an account. Other collateral options (e.g. livestock herd; crops in safe and accredited storage) are generally not recognized in formal operations. Informal loans are exploitative and expensive. Five private commercial banks dominate rural lending and there are a range of micro finance institutions, the top one being the National Rural Solidarity Program.

Since independence, Pakistan has not developed equity in land allocations, or a transparent and fully functioning land administration system. Land administration and accountability appears challenged; it is difficult and costly to access records, which turn out to be inherently unreliable. IT is not used in maintaining land registry records.

Though many federal ministries and agencies and provincial departments administer agriculture, land, water, and natural resources, there is no coordinated approach to linking strategic objectives and provincial implementation to assist farmers and agribusiness. Everyone seems to rely on the Planning Commission, which is not an implementing body. More work is needed to document which organizations are directly or indirectly involved in the sector to better appreciate the regulatory and operational framework to assist mobilizing sustainable supply and value chains.

Many agriculture value chains identified here will struggle to sustain themselves and adopt best practices in the absence of assistance. Such assistance should focus on policy reforms in specific commodities, on raising farm productivity and energizing commodity markets by improving credit and business development services, on targeting growth of small and medium-scale farming, and on involving women in positive roles.

SECTOR POLICY

Wheat accounts for about three quarters of grain production in Pakistan and is sown on over a third of all cropped land. Because of its symbolic and practical importance, it is a major exception to the government’s commitment to market price regimes for food and food crops. For decades the government has used a system of “procurement price” and “issue price.” The procurement price is usually less than the landed cost of imported wheat. Flour mills purchase wheat according to a quota based on milling capacity, and many likely sell their output at a higher margin than

they are supposed to. This system can be characterized as an untargeted subsidy to flour consumers financed in large part by a tax on wheat producers. Drawbacks are numerous:

- Farmers have little incentive and ability to produce more.
- Handling and storage are inefficient, and post-harvest losses are large.
- Government is rarely able to procure targeted volumes at the pre-set procurement price.
- Flour mills overinvest in capacity.
- When provincial governments try to procure targeted quantities they create a "need" for bans or administrative restrictions on inter-district/interprovincial procurements that further discourage private investment in wheat marketing and storage.
- The system compels a ban on legal exports of wheat from Pakistan into Afghanistan while creating an incentive for clandestine trade.

Yet Pakistan is still a marginal importer/exporter of wheat. It is reasonable to suppose that a movement toward less government control of wheat marketing complemented by other productivity enhancing measures could make Pakistan a reliable supplier of wheat to Afghanistan and to some distances beyond.

If wheat and flour pricing policies are the most urgent problem facing Pakistan's food and agriculture system, water is the most important one. Without the Indus irrigation system agriculture in Pakistan would scarcely exist. Pakistan is headed for water scarcity, possibly by 2035, because of population growth. And there is nothing to be done about it; there is simply no additional water to be injected into the system. Moreover, 15 million tons of salt accumulate in the Indus Basin every year from evaporation; without sediment, the Indus delta is degrading rapidly. Groundwater, which now accounts for about half of all irrigation is overexploited and becoming salinized, yet tens of thousands of additional wells are being put into service every year. In the barani areas of Balochistan, farmers (using subsidized electricity) are pumping from depths of hundreds of meters and in the sweet water areas of the Indus Basin, depletion is now a fact in all canal commands. There is an urgent need to bring withdrawals into balance with recharge and since much groundwater recharge in the Indus Basin –about 80 percent—is from canals, this requires an integrated approach to surface and groundwater.

As if growing water demand colliding with static supply, salt accumulation, and degradation of the Indus delta were not enough bad news, climate change will pose even harsher challenges to Pakistan. The Indus basin depends heavily on the glaciers of the western Himalayas which act as a reservoir, capturing snow and rain, holding the water and releasing it into the rivers which feed the plain. It is now clear that climate change is already affecting the western glaciers far more seriously than in the damper Eastern Himalayas. While the science is still in its infancy, best estimates are that there will be 50 years of glacial retreat, during which time river flows will increase. But then the glacial reservoirs will be empty, and there are likely to be dramatic decreases in river flows conceivably by a terrifying 30 percent to 40 percent in 100 years time.

Even in the shorter term much of the water infrastructure is in poor repair. Because of a combination of age and what has aptly been called the "build/neglect/rebuild" philosophy of public works, much of the infrastructure is crumbling. This is true even for some of the major

barrages, which serve millions of hectares and where failure would be catastrophic. There is no modern asset management plan for any major infrastructure.

Although Pakistan's irrigation infrastructure is vast, almost all of it is for diverting annual flows from North and West to South and East. Storage of water per capita in Pakistan is miniscule, 150 M^3, compared to Egypt at 2200 M^3 or the United States and Australia at over 5000 M^3. Put another way, the dams of the Colorado and Murray- Darling Rivers can hold 900 days of river runoff, South Africa 500 days, India 120 to 220 days. By contrast, Pakistan can store barely 30 days of Indus water. And with the high silt loads from the young and still growing Himalayas Pakistan's two large reservoirs have already lost about 10 percent of their capacity.

The final piece of bad news, but one that holds considerable hope for improvement, is that water productivity in Pakistan is low. Crop outputs, both per hectare and per cubic meter of water, are much lower than international benchmarks, and much lower even than in neighboring areas of India. Output of sugarcane, a crop that needs four times as much water to produce a Rupee of output as wheat, has been growing almost twice as fast as the staple grain. The fact that water users do not pay anything approaching the scarcity value of water plays an important role in inefficient use: yields from reliable, self-provided groundwater are twice those of unreliable and inflexible canal supplies. Better choice of crops could have a high payoff and allow time for longer term measures to be put in place.

How do farmers know which crops are the best choices? The agriculture knowledge chain links basic, applied, and adaptive research. In the 1960s, Pakistan was a major beneficiary of the Green Revolution, which adopted new wheat varieties to local conditions and practices. Today the model of research and extension has broken down. Spending on research had declined; a high percentage of funding is spent on salaries; and communication and coordination among institutes is poor. Consequently, research tends to focus on maintenance rather than innovation or productivity. Weak policymaking capacity also takes a toll; for example, little is done to collect data on commodity prices, a cornerstone for policymaking.

The rural business climate is also of some concern. The ability to freely own agricultural land and to easily transfer and register that ownership is a fundamental requirement of agricultural growth in a free-market economy. Without secure rights to their land, for example, farmers have few incentives to invest and devote fewer resources to defending their rights. Problems with land registration and clouds on land titles are impeding a variety of desirable outcomes: the ability of rural entrepreneurs—especially women—to start businesses and obtain capital; the security of investments in real property; the efficiency and effectiveness of the courts in all civil matters; access to credit; and the overall rural income growth of Pakistan.

The legal and institutional systems relating to land registration and transfer of title are quite slow and costly. The annual World Bank Doing Business survey shows a steady decline in Pakistan's ranking for Registering Property: it fell from 57 in the 2006 survey to 97 in the 2009 survey. In addition, there are important social concerns arising from poor understanding and awareness of the laws, access to the implementing institutions, and enforcement of property rights, especially among women. As very little rural land has clear, registered title, use of real estate to secure

credit is problematic in Pakistan. A lender cannot know whether the land being offered as collateral has been given to another person who may have a legitimate claim on the property should the borrower default. Consequently, banks are reluctant to rely on mere registration.

Under the colonial era Agricultural Marketing Act—now the Provincial Agricultural Marketing Act—only provincial governments may own and operate regional and district markets. A public agency acquires the land, installs facilities, and puts up buildings to be used by traders. Only traders to whom space has been rented can participate. Not only does this limit the efficient provision of services, but it also limits the number of traders in rural areas and creates or reinforces monopsonistic power of traders to exploit small farmers who have few alternatives for selling their output.

Although not specifically aimed at the rural business environment, annual surveys of the World Bank and IFC compare business climates among 167 countries. Pakistan's ranking has fallen markedly in the past three years, from 66 to 77. The survey reflects scores if not hundreds of policies, some of which affect some sectors more than others, that affect growth and investment by private firms, including rural firms and firms that serve rural markets.

Urea, $(NH_2)_2CO$, and DAP (diammonium phosphate) $(NH_4)_2HPO_4$) are the most widely used fertilizers in Pakistan. Their pricing is largely unregulated and both are produced and mixed by private companies. They are freely importable. Natural gas, the primary feed-stock and energy source for the production of urea, is supplied to urea plants at price somewhat below the price of importing gas, so some subsidy is implied and the subsidy may have increased with increases in gas prices internationally. Domestic prices of urea have not increased in tandem with international prices, which have increased much more than food grains, perhaps because of informal government suasion. To reduce the shortage, the Government of Pakistan—through the Trading Corporation of Pakistan--imported urea and resold it at a reported loss of $100 million.

The development of a gap between domestic and international prices of urea has led to some of the same problems as with wheat. Even temporary shortages can have large negative impacts on output if urea is not applied at the right point in the growing cycle.

What steps can USAID take to address at least some of these aspects of the "policy" situation? Policy options in Pakistan are not well understood. The technical levels of government are challenged to quantify the merits and demerits of options for decisions makers, and civil society is equally challenged in participating in fact-based dialogue about policy. In addition, each policy should be informed by an understanding of who would and would not benefit from reforms that a policy might entail.

- ***Increase government capacity for policy analysis and civil society demand that expanded capacity result in better policies.***
  - — ***Finance assistance at various levels of government and civil society.*** USAID should consider financing assistance to federal and provincial agencies as well as university departments of agriculture, trade associations, think tanks, and NGOs working on food and agriculture issues. Such financing can support short- and long-term domestic and foreign consultants; exchange and advanced study programs with U.S. universities, think

tanks, and international institutions; data collections and surveys; and publications, websites, and conferences.

— ***Focus agency level assistance on certain issues.*** Assistance may be used to support a variety of efforts, such as food subsidy targeting the urban and rural poor; improved data collection and electronic dissemination of agricultural prices and transactions; CGE modeling of the economy with disaggregation of the agricultural sector; farm and crop model templates; value chain analysis; and empirical analysis of policy and policy implementation.

- ***Strengthen knowledge chains.*** Fund a diagnostic study of the research and extension system, including the role of the private sector to inform investment in management audits of research institutes and provincial extension departments; capacity building in institutes and universities through staff exchanges and PhD programs with U.S. institutions; advanced training for scientific and social science specialties; and government-NGO-business partnerships for the development and promotion of new seeds, agricultural chemicals, mechanization, cultivation, and water conservation techniques.
- ***Recreate capacity for Indus Basin water management.*** Dealing with the Indus Basin is an intellectual challenge of the first order, but Pakistan's knowledge base and institutional and human systems are not up to the task. USAID has an opportunity to help Pakistan begin to address decades of intellectual disinvestment in Indus system management by

  — Building capacity for water management by providing consulting services, advanced training abroad in scientific and engineering fields, and exchanges and internships with other large river management systems.

  — Developing a hydro-economic model of the Indus Basin linked to agricultural models and global climate change models, fed by remote sensing/satellite data.

  — Developing programs over time to shift land in sugar cane to other crops. This entails crop and economic analysis, designing incentives and disincentives, and devising an information strategy.

  — Investing in small-scale hydro/water storage, re-feasibility studies for major works, and remote/satellite sensing of rainfall/water flow/snowmelt/land use.

  — Strengthening water policy in areas such as user charges, rights transferability, and water user associations.

1. Introduction

Until 1992, USAID was a major supporter of Pakistan's agricultural development programs but since then its assistance has deemphasized agriculture. As it prepares to re-engage in the agriculture sector, USAID requires information on which to base a new food and agriculture program and recommendations for program design and investments in sustainable production systems and stronger, more diverse agricultural value chains.

PURPOSE

This report presents sector data, analysis, and findings on Pakistan's food and agriculture systems to guide USAID/Pakistan mission in designing a project that will be a part of USAID's food security initiative. That project has two major goals: (1) increase the value of food staple production, and (2) reduce impediments in food marketing and market access systems. While recognizing the importance of the enabling environment and policy frameworks, programmatic recommendations presented herein focus on private sector led interventions. Particular attention is paid to cereal crops, wheat, rice, and maize. Given the stiff competition for scarce water, oilseed and sugar are covered as well, along with livestock, a large and well-performing subsector, and horticulture, a promising subsector. The geographic focus of the report is the greater Indus watershed, which confines findings to the Punjab and Sindh provinces, although links to parts of Balochistan and NWF Provinces and to Azad Jammu and Kashmir State are recognized where these areas are serviced by water from the Indus and Kabul Rivers or their tributaries.

METHODOLOGY

From August 25 to September 8, 2008, a team of specialists visited Islamabad, Karachi, Lahore, and Faisalabad. The team consisted of a food and agriculture policy reform specialist, a national specialist, a program economist from Nathan Associates, an expatriate agriculture value chain specialist, and a national specialist from J. E. Austin Associates. An irrigation specialist conducted a desk study in Washington, D.C.

The team conducted desk research and discussions in Islamabad; met with stakeholders from the public and private sectors, nongovernmental organizations (NGOs), and USAID-funded programs in the Punjab and Sindh Provinces; and presented findings to USAID in Pakistan. Team members led focus group discussions and interviewed representatives from research and education institutions; small, medium and large agribusinesses; NGOs; rural finance and credit service providers; and officers of federal and provincial governments, federal investment facilitation agencies and multilateral institutions. During visits to the Punjab and Sindh Provinces, the team

met with entrepreneurs and traders, industry associations, NGOs, and representatives of the federal and provincial governments. They met a cross-section of organizations in the agricultural and rural sectors, including

- Agricultural input suppliers (research and development, seed, fertilizer, plant protection),
- Grower associations,
- The wheat subsector (procurement, flour millers),
- Rice subsector (research and development, producers, millers, exporters),
- Maize subsector (feed millers and poultry industry as consumers),
- Rural and agribusiness banking and credit service providers,
- Provincial Planning and Development departments,
- The Ministry of Food, Agriculture and Livestock (MINFAL),
- The Board of Investment, and
- The Planning Commission.

Field findings are supported by literature reviews. A range of information on Pakistan's agriculture sector is available, although much is anecdotal. USAID/Pakistan has copies of all local source documents obtained during the report period.

An unwritten theme underpinning findings is that since independence in 1947 Pakistan has been challenged to develop with stakeholders and articulate a consistent and modern strategic direction for investment in the agriculture, water, forestry, natural resources, and related sectors. Pakistan retains a top-down political approach, with strong influence by traditional groupings, including heredity landlords and the military. The government struggles to establish sound federal and provincial institutions led and staffed by skilled and ethical professionals. The field team had essentially unrestricted access to all discussion venues; everyone—the public and private sectors, NGOs, those in the informal sector, and associations—was willing to raise and discuss issues and was prepared to prompt positive change and work together.

ORGANIZATION

In Chapter 2 we describe the agriculture sector as a whole. Chapter 3 presents data, analysis, and findings on the irrigation sector; Chapter 4 covers value chains; and Chapter 5 discusses agriculture policy issues. Chapter 6 summarizes recommendations presented throughout the report. Organizations visited and persons interviewed are listed in Appendix A.

2. Agriculture Sector

Pakistan's agriculture sector consists of four subsectors: food and fiber crops and horticulture, livestock and dairy, fisheries, and forestry. In this section we describe Pakistan's agriculture systems in general, and the food, fiber crops, and horticulture subsector in particular. We explore direct and indirect influences on sector productivity and growth, including policy matters that are explored in greater detail in other sections of this report. We note, though, that while many policies may need to be revisited and modified, the biggest problems are with implementation, compliance and enforcement, that is, governance.

MACROECONOMIC CONTEXT

National and global economic changes—inflationary oil prices and skyrocketing food prices—and national political uncertainty, compounded by deterioration in law and order, are causing turmoil in Pakistan's economy. Growth has slowed, productivity and exports have declined, and the trade deficit has widened. Stagnant wheat production and an unprecedented level of informal wheat trade to neighboring countries have made Pakistan's food supply insecure.

Still, the gross domestic product (GDP) grew 5.8 percent in 2007/08, only one percentage point less than the previous year.[1] This growth came largely from the service sector, which grew 7 percent, while manufacturing and agriculture growth fell short of expectations. Agriculture overall grew 1.5 percent, mainly because the livestock subsector grew by 3.8 percent. These gains, however, were offset by negative 3 percent growth in the major crop. Wheat shortages, high fuel costs, and international price hikes in general pushed inflation overall to 17.2 percent and food inflation to 25 percent in the first quarter of 2008. The terms of trade for agriculture have improved but any benefits have been eroded by sharp increase in the prices of imported inputs, such as fertilizers, agrochemicals, and diesel for agricultural machinery.

The abrupt increase in the price of imported goods has affected trade and the current account deficit. The deficit in the balance of payment will have to be met through foreign exchange reserves, which, however, cannot be sustained at the current rate.

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[1] See Table 1.2, Growth Performance of Components of Gross National Product: Pakistan Economic Survey 2007-08. Economic Advisor's Wing. Finance Division. Government of Pakistan. Islamabad. June 2008.

Sector Contribution to National Economy

Pakistan's traditional, subsistence agriculture is slowly becoming commercial. Its share of GDP in 2007/08 was about 20.9 percent, [2] it employs about 44 percent of the labor force, and it fetches about 70 percent of the foreign exchange through exports of raw, semi-processed, and processed commodities. Directly and indirectly, the sector is the main source of income for about 66 percent of the rural population and is key to poverty reduction[3] and national food security.

In the 1960s, the introduction of high yielding and fertilizer responsive crops and expansion of the land base and irrigation water supply raised sector productivity.[4] This was sustained till late 1980s. Growth was to some extent maintained through continued varietal replacement and crop diversification, but the shift to high value crops was largely achieved through expansion in the area under sugarcane, orchards, vegetables, and nontraditional oilseed crops. Little was done, however, to reduce post-harvest losses and boost value addition. Since the 1990s, total factor productivity has grown only very slowly and is now stagnant. The slow pace of technical change is due to inadequate investment in research and development, development and dissemination of higher production packages, agricultural education and extension system, and physical infrastructure. Resource degradation and the dominance of the public sector in agricultural trade and price controls have compounded these problems.

Resource Base

Land

Out of 34.5 million hectares of arable land in Pakistan, about 22 million are cultivated, 8.3 million are non-cultivated arable, and about 4.2 million are forest.[5] The soils are predominantly calcareous, with pH ranging between 7 and 8. About 21 percent of the area is affected with surface salinity, 7 percent severely, 4 percent moderately, and 10 percent slightly.[6]

According to the Census of Agriculture 2000, farm size distribution is skewed.[7] There are about 6.3 million farms and the average size is 3.23 ha. About 86.2 percent are under 5 ha., accounting for 38.5 percent of farm area; 7.8 percent are medium size and account for 16.2 percent of the area; and about 6 percent are large and take up more than 45.3 percent of the area (Table 2-1). The number of operational units is about 6.6 million.[8] The small operators are about 85.7 percent and they operate about 43.4 percent of the farm area, while 8.8 percent medium size farm

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[2] Ibid

[3] During 2005/06, the poverty incidence in Pakistan (headcount) was estimated to be 22.3 percent (urban 13.1 percent and rural 27 percent). Pakistan Economic Survey 2007-08, Table 1-2.

[4] Various issues of Pakistan Economic Surveys and Agricultural Statistics of Pakistan..

[5] Table 61: Agricultural Statistics of Pakistan 2006-2007. Economics, Trade & Investment Wing, Ministry of Food, Agriculture & Livestock. Islamabad

[6] This data is for the period 2001-2004 (most recent data available).

[7] Over time the situation may have improved, nonetheless, the distribution is still perceived to be skewed.

[8] Agriculture Census 2000.

operators share about 19.1 percent of the area. The large farmers are about 5.6 percent and they operate 37.5 percent of the area (Table 2-2). About 77.6 percent of the farms are self plowed by owners operating 73.3 percent of the area. Similarly, 8.4 percent of farms are operated by owner-cum-tenants cultivating 14.5 percent of the area. The remaining 14 percent of farms spread over 12.2 percent of the area are run by tenants (Table 2-3).

This data suggests that most farms are less than the economic landholding size of 5 ha. Most small farms are jointly owned and the ownership has not been mutated, or updated to the individual owners. Time series data suggest that the number of small operators has been on the rise, without ownership. The situation is worsened where land is fragmented. Despite the policy that farms should not be smaller than 5 ha., many are. This has discouraged investment in land development, farm structures, and purchase of machinery.

The antiquated land titling system provides ample opportunity for ownership and occupancy status manipulation by the revenue staff, who are custodians of land records. This discourages efficient land markets, investment in land, and the use of land as collateral for formal credit. ***Pakistan needs a land record policy based on digitized cadastral maps and an electronic land titling system; and that system must be transparent and easily accessible by farmers and the banking system. Such a system would also be of great assistance in formulating and enforcing a policy on minimum economic farm size.***

Water

About 85 percent of Pakistan's cropped area is irrigated by canals. The main sources of irrigation are rivers, streams, and springs (surface), dugwells and tubewells (subsurface), and torrential flows in dry washes. River water is diverted through dams, barrages, and head works into main, branch, and minor canals, and to farm ditches through watercourses. The federal government's Water and Power Development Authority (WAPDA) manages large dams, and provincial irrigation departments (PIDs) manage barrages and downstream networks. Drought and inadequate snowmelt over the past ten years led to big swings in water availability at canal heads. During the 1990s more than 100 million acre feet were diverted annually into the heads; by 2001/02 only about 79.6 million acre feet were being diverted, then in 2006/07 availability was restored to about 102 million acre feet.

Tubewells are an important source of irrigation, particularly in the Punjab province. In the last ten years the number of private tubewells has increased from 506.8 thousand to 964.3 thousand (Table 2-4). During this period, the level of groundwater abstraction did not increase commensurate with the number of tubewells. In 1996/97, 37.4 million acre feet were available from private tubewells; in 2006/07 about 40.4 million acre feet were available.[9] This is in addition to the about 19,000 public sector subsurface drainage tubewells in the brackish zone. Such "over-mining" and attendant saline encroachment into fresh groundwater areas could damage aquifers permanently. ***Underground water laws need to be promulgated and implemented to check the mushrooming growth of tubewells and the high rate of abstraction.***

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[9] Agriculture Statistics of Pakistan 2006/07.

Table 2-1

Area of Farms (Ownership) By Size of Farms, 2000

Size (Hectares)	Farms		Farms Area		Avg. size (Hectares)
	Number	%	Hectares	%	
All Farms	6,311,356	100.0	20,366,993	100.0	3.23
Under 0.5	1,455,802	23.1	401,662	2.0	0.28
0.5 to under 1.0	1,107,723	17.6	821,341	4.0	0.74
1.0 to under 2.0	1,297,226	20.6	1,782,716	8.8	1.37
2.0 to under 3.0	838,310	13.3	1,949,053	9.6	2.32
3.0 to under 5.0	744,114	11.8	2,883,253	14.2	3.87
Small Farms	5,443,175	86.2	7,838,025	38.5	1.44
5.0 to under 10.0	491,420	7.8	3,297,276	19.0	6.71
Medium Farms	491,420	7.8	3,297,276	16.2	6.71
10.0 to under 20.0	249,859	4.0	3,181,750	15.6	12.73
20.0 to under 40.0	86,506	1.4	2,199,333	10.8	25.42
40.0 to under 60.0	19,941	0.3	894,496	4.4	44.86
60.0 and above	20,455	0.3	2,956,113	14.5	144.52
Large Farms	376,761	6.0	9,231,692	45.3	144.52

SOURCE Census of Agriculture 2000.

Table 2-2

Number of Operational Units and Area of Farms by Size of Farms, 2000

Size (Hectares)	Farms		Farms Area		Avg. size (Hectares)
	Number	%	Hectares	%	
All Farms	6,620,054	100.0	20,406,782	100.0	3.08
Under 0.5	1,290,098	19.5	362,544	1.8	0.28
0.5 to under 1.0	1,099,330	16.6	821,245	4.0	0.75
1.0 to under 2.0	1,425,370	21.5	1,981,277	9.7	1.39
2.0 to under 3.0	966,411	14.6	2,256,772	11.1	2.34
3.0 to under 5.0	890,755	13.5	3,442,507	16.9	3.86
Small Farms	5,671,964	85.7	8,864,345	43.4	1.56
5.0 to under 10.0	580,200	8.8	3,891,228	19.0	6.71
Medium Farms	580,200	8.8	3,891,228	19.1	6.71
10.0 to under 20.0	260,791	3.9	3,324,310	16.3	12.75
20.0 to under 40.0	77,773	1.2	1,955,330	9.6	25.14
40.0 to under 60.0	15,277	0.2	689,070	3.4	45.11
60.0 and above	14,054	0.2	1,682,491	8.2	119.72
Large Farms	367,895	5.6	7,651,201	37.5	119.72

SOURCE Census of Agriculture 2000

Table 2-3

Number of Private Farms By Tenure, 2000

Tenure	Farms		Farms Area	
	Number	%	Hectares	%
Owner cultivator	5,134,504	77.6	14,961,275	73.3
Owner-cum-tenant	558,991	8.4	2,963,441	14.5
Tenant	926,562	14.0	2,482,061	12.2
Total	6,620,057	100.0	20,406,777	100.0

Table 2-4

Water Availability at Farm Gate (Million Acre-Feet)

Year/Season	Surface Water		Ground Water				Total
	At Canal Head	At Farm Gate	Public T.wells	Private T.wells	Scarp T.wells	Other Pr. T.wells	
1996-97	111.12	81.69	12.96	37.40	-	-	132.05
1997-98	103.14	81.95	1.93	38.27	-	-	122.15
1998-99	110.70	82.71	1.93	38.63	10.51	0.00	133.78
1999-00	106.70	83.37	1.93	38.27	9.71	0.00	133.28
2000-01	86.17	84.22	1.93	39.35	9 27	0.00	134.77
2001-02	79.61	84.34	1.93	39.71	8.65	0.00	134.63
2002-03	96.41	84.46	1.93	40.08	8.01	0.00	134.48
2003-04	103.15	84.76	1.93	40.08	8.01	0.00	134.78
2004-05	85.92	85.66	1.93	40.08	8.01	0.00	135.68
2005-06	104.53	87.06	1.93	40.38	8.01	0.00	137.38
2006-07	101.96	87.48	1.93	40.38	8.01	0.00	137.80

Note Surface water at farm gate includes canal supplies +OFWM+small dams.

SOURCE Planning & Development Division (Water Resources Section) and IRSA.

Under institutional reforms supported by development partners, provincial irrigation and drainage authorities (PIDA) of end users have been created to manage the system. These reforms have progressed very slowly. In each province a PIDA Act has been promulgated and area water boards have been established for some canal commands.

Irrigation infrastructure is in severe disrepair as maintenance has been deferred due to lack of resources. Irrigation user charges (water rates or *abiana*) have not increased in a decade, further widening the gap between irrigation expenditure and allocations. Drainage infrastructure is also in poor condition. The meager drainage cess and inadequate O&M allocation is causing further breakdown. Moreover, water delivery and field application are both very inefficient, and the rate of abstraction is very high. A national water policy formulated by the Ministry of Water and Power, with consensus among stakeholders, is awaiting cabinet approval. ***Water charges and drainage cess should be rationalized according to crop water requirements and the cost of delivery at the farm gate. The national water policy needs to be approved and operational as soon as possible.***

Mechanization

There are about 400,500 tractors in the country. About 83 percent are in the Punjab province.[10] In 2006/07, 54,431 tractors were assembled in Pakistan and another 2,567 were imported. Most farmers use tractor-drawn blades, cultivators, and ridgers to prepare seed beds. Deep plows, furrow turning plows, chisels, rotavators, mechanical seed planters, sprayers, and combines are in limited use. The other most common use is tractor-operated threshers, and haulage of inputs and produce from and to market. Tractor-drawn implements such as mould board plow, seed planters, fertilizer dusters, pesticide spraying, and harvesting are in limited use. To encourage mechanization, the import duty on agricultural machinery is kept at the minimum.

FOOD AND AGRICULTURE SYSTEMS

An arid country with a subtropical climate, Pakistan has two regions: highlands and Indus plain. Most parts of the country have dry climate, save for parts of the northern highlands. The average annual precipitation in the Indus plain and mountainous regions of Balochistan is less than 250 mm, while northern highland areas may receive up to 750 mm rain annually. Indus plain is made up of piedmont plains, alluvial terraces, active flood plains, deltaic plains, and rolling sand plains and dunes. This wide physiographic and climatic variance presents an opportunity for diverse cropping patterns and prospects for off-season vegetables and high value crops. In the following paragraphs, we briefly describe these, with due emphasis on food and fiber production.

Food and Fiber Production

In 2006/07, Pakistan's total cropped area was about 23.4 million ha. (Table 2-5). Of that, about 56 percent was allocated to food crops, 18 percent to cash crops, 6 percent to pulses, and 3 percent to oilseeds. About 4 percent were under orchards, 2 percent vegetables, and 1 percent condiments. The remaining 10 percent was allocated to minor crops and fodder (Table 2-6). Between 1990/91 and the last year, the area under food crops increased from 11.9 million ha. to 13.1 million ha., an increase of 9.5 percent (Table 2-6). The areas devoted to oilseeds, vegetables, and fruits increased by significant proportions (54, 35 and 83 percent, respectively). The most notable increase is in the area under fruit orchards, which almost doubled in the same period. Similarly the area devoted to pulses has declined slightly. A significant decrease may be noted in the area devoted to other crops. This indicates that farmers are adjusting cropped area on the basis of profitability and gradually shifting to higher value crops.

The average yield of various crops, particularly food crops, is lower than realized elsewhere in the region. It is significantly lower than the average yields in the developed countries. With the increased use of fertilizer and pesticides, the gap has narrowed over time. Nonetheless, it is still much lower than the potential (see Table 2-7).

[10] Agricultural Statistics of Pakistan 2006/07: Table 116

Table 2-5

Land Utilization 1990/91–2006/07 (Million Hectares)

Year/ Province	Geographical Area	Total Area Reported. (4 to7)	Forest Area	Not Available for Cultivation	Cultivatable Waste	Cultivated Area (8+9)	Current Fallow	Net Area Sown	Area Sown More Than Once	Total Cropped Area (9+10)
1	2	3	4	5	6	7	8	9	10	11
1990/91	79.61	57.61	3.46	24.34	8.85	20.96	4.85	16.11	5.71	21.82
1991/92	79.61	57.87	3.47	24.48	8.86	21.06	4.87	16.19	5.53	21.72
1992/93	79.61	58.06	3.48	24.35	8.83	21.40	4.95	16.45	5.99	22.44
1993/94	79.61	58.13	3.45	24.43	8.74	21.51	5.29	16.22	5.65	21.87
1994/95	79.61	58.50	3.60	24.44	8.91	21.55	5.42	16.13	6.01	22.14
1995/96	79.61	58.51	3.61	24.35	8.87	21.68	5.19	16.49	6.10	22.59
1996/97	79.61	59.23	3.58	24.61	9.06	21.98	5.48	16.50	6.23	22.73
1997/98	79.61	59.32	3.60	24.61	9.15	21.96	5.48	16.48	6.56	23.04
1998/99	79.61	59.28	3.60	24.52	9.23	21.93	5.35	16.58	6.28	22.86
1999/00	79.61	59.28	3.78	24.45	9.09	21.96	5.67	16.29	6.45	22.74
2000/01	79.61	59.44	3.77	24.37	9.17	22.13	6.73	15.40	6.64	22.04
2001/02	79.61	59.33	3.80	24.31	8.95	22.27	6.60	15.67	6.45	22.12
2002/03	79.61	59.45	4.04	24.25	8.95	22.21	6.61	15.60	6.25	21.85
2003/04	79.61	59.46	4.01	24.23	9.10	22.12	6.23	15.89	7.05	22.94
2004/05	79.61	59.48	4.02	24.39	8.94	22.13	6.86	15.27	7.51	22.78
2005/06	79.61	57.22	4.03	22.87	8.21	22.11	6.72	15.39	7.74	23.13
2006/07	79.61	57.22	4.19	22.70	8.33	22.00	6.49	15.51	7.88	23.39

* = Nominal./R = Repeated of last year.

Source:-.

Notes: *Geographical area* is that which has been surveyed and calculated by the Survey of Pakistan. *Total area reported* is the total physical area of the village/dehtehsil or district. *Forest area* is the area of any land classed or administered as forest under any legal enactment dealing with forests. Any cultivated area that may exist in such a forest should be excluded (and shown under heading *Cultivated Area*) *Area not available for cultivation* is that uncultivated area of the farm which is under farm homesteads, farm roads and other connected purposes and therefore not available for cultivation. *Cultivatable waste* is uncultivated farm area fit for cultivation but not cropped during the year referenced or in the year before that. *Cultivated area* is the area that was sown at least during the year under reference or the previous year. *Cultivated Area* = Net Area sown + Current Fallow. *Current fallow* is that which is vacant during the year under reference but was sown at least once in the previous year. *Net area sown* is the area that is sown at least once during the year under reference. *Area sown more than once* is the difference between the total cropped area and the net area sown. *Total cropped area* means the aggregate area of crops raised in a farm during the year under reference, including the area under fruit trees.

SOURCES Provincial Agriculture Departments. Adapted from Table 61 Agricultural Statistics of Pakistan 2006/07

Table 2-6

Distribution of Cropped Area ('000' hectares)

Year	Food		Cash		Pulses		Oilseeds		Vegetables		Condiments		Fruit		Others		Total
	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	Ha.	%	
1990-91	11933	55	3938	18	1538	7	496	2	280	1	139	1	456	2	3040	14	21820
1991-92	11667	54	3995	18	1420	7	523	2	291	1	166	1	464	2	3194	15	21720
1992-93	12191	54	4030	18	1453	7	540	2	299	1	132	1	476	2	3319	15	22440
1993-94	11918	55	4024	18	1481	7	496	2	311	1	174	1	540	2	2926	13	21870
1994-95	12296	56	3937	18	1511	7	572	3	325	1	181	1	566	2	2752	12	22140
1995-96	12473	55	4202	19	1599	7	620	3	289	1	185	1	622	3	2600	11	22590
1996-97	12113	53	4332	19	1575	7	679	3	301	1	196	1	629	3	2905	13	22730
1997-98	12618	55	4234	18	1565	7	665	3	325	1	192	1	640	3	2801	12	23040
1998-99	12598	55	4288	19	1531	7	656	3	334	1	195	1	646	3	2612	11	22860
1999-00	12734	56	4182	18	1419	6	619	3	331	1	216	1	658	3	2581	11	22740
2000-01	12358	56	4078	18	1329	6	523	3	323	1	208	1	672	3	2549	12	22040
2001-02	11999	54	4339	20	1380	6	579	3	329	1	169	1	664	3	2661	12	22120
2002-03	11990	55	4069	19	1424	7	572	3	340	2	180	1	652	3	2623	12	21850
2003-04	12657	55	4291	19	1447	6	709	3	346	2	182	1	735	3	2573	11	22940
2004-05	12603	55	4343	19	1492	7	694	3	351	2	193	1	795	3	2309	10	22780
2005-06	12896	56	4200	18	1405	6	729	3	364	2	230	1	815	4	2482	11	23121
2006-07	13066	56	4320	18	1472	6	764	3	379	2	197	1	833	4	2359	10	23390
% change 1990-91 to 2006-07	9.5		9.7		-4.3		54.0		35.4		41.7		82.7		-22.4		7.2

Notes: Vegetables include potatoes. Food crops—wheat, rice, jowar, maize, bajra and barley. Cash crops—sugarcane, cotton, tobacco, s. beet, jute and guarseed. Pulses—gram, mung, mash, masoor, mattar, other kharif and rabi pulses. Oilseeds—rapeseed and mustard, sesamum, groundnut, linseed, castorseed and other oilseeds. Condiments—chilies, onion, garlic, coriander, turmeric, and ginger.

SOURCES *Provincial Agriculture Departments. Table 62 Agricultural Statistics of Pakistan 2006/07*

As Table 2-7 shows, during the past few years wheat production has oscillated around 21 million tons from an average annual area of 8.4 million ha. with an average wheat yield of about 2.5 million tons per ha. The gap between supply and demand is met through imports. While estimating the domestic demand for wheat, the provision of 0.6 million MT to meet the wheat demand from Afghanistan must also be considered. Similarly, the average annual area under rice is about 2.5 million ha., producing an annual average of 5.5 million MT with an average yield of 2.2 MT per ha. Maize is grown on about 1 million ha. annually producing about 3 million MT. Cotton is grown on about 3 million ha., producing about 11-12 million bales. Sugarcane is grown on about 1 million ha. annually, producing an average of 55 million MT.

Table 2-7

Summary of Area, Production, and Yield of Selected Agricultural Commodities

Crop	2005-06			2006-07		
	Area ('000'Ha)	Production ('000' ton)	Yield (Kgs/Ha)	Area ('000'Ha)	Production ('000' ton)	Yield (Kgs/ Ha)
Wheat	8,447.9	21,276.8	2,518.6	8,578.2	23,294.7	2,715.6
Rice	2,621.4	5,547.2	2,116.1	2,581.2	5,438.4	2,106.9
Maize	1,042.0	3,109.6	2,984.3	1,016.9	3,088.4	3,037 1
Sugarcane	907.3	44,665.5	49,229.0	1,028.8	54,741.6	53,209.2
Cotton (000 bales)	3,103.0	13,018.9	713.7	3,074.8	12,856.2	711.2
Tobacco	56.4	112.6	1,996.5	50.9	103.3	2,029.5
Sugar beet	3.1	93.4	30,129.0	2.0	83.6	41,800.0
Clusterbean	130.8	99.1	757.6	163.8	120.9	738 1
Gram	1,028 9	479.5	466.0	1,052.3	837.8	796.2
Mungbean	208.5	113.9	546.3	217.8	138.5	635.9
Mash	34.6	16.5	476.9	33.2	15.9	478.9
Masoor	33 9	17.9	528.0	39.0	21.1	541.0
Mattar	90.3	52.4	580.3	120.7	71.2	589.9
Other K Pulses	6.6	3.8	575.8	8.0	4.1	512 5
Other R Pulses	1.7	0.8	470.6	1.3	0.7	538.5
Rapeseed & Mustard	216.6	171.6	792.2	255.9	212.3	829.6
Canola	10.7	9.2	859.8	9.9	8.7	878.8
Groundnut	93.7	69.1	737.5	93.5	73.9	790.4
Sesamum	82.0	35.1	428.0	71.4	30.4	425.8
Onion	148.7	2,055.8	13,825.2	131.4	1,816.5	13,824.2
Garlic	7.0	57.3	8,185.7	7.8	62.3	7,987 2
Chilies	64.6	122.9	1,902.5	47.3	69.5	1,469.3
Potato	117.4	1,567.9	13,355.2	133.4	2,581.6	19,352.3
Tomato	46.2	468.1	10,132.0	47.1	502.3	10,664.5
All Vegetables*	246.3	3,124.8	12,687.0	245.5	3,138.0	12,782.1
All Fruits	814.5	7,147.6	8,775.4	832.9	6,011.3	7,217.3

SOURCE - Crop Reporting Services of Provinces

** = Excluding Potato*

Livestock Production

During the past two decades the livestock sector has grown steadily, and it now contributes about half of agriculture's share of GDP. During 2006/07 the large ruminant (cattle and buffaloes) population was estimated at 56.9 million heads, and small ruminants (goats and sheep) were estimated at 90.3 million.[11] (Table 2-8).

[11] Agriculture Statistics 2006/07

Table 2-8
Livestock Population

	1960	1972	1976	1986	1996	2006
Cattle	16,624	14,674	14,855	17,541	20,424	29,559
Buffaloes	8,161	9,751	10,611	15,705	20,272	27,335
Sheep	12,378	13,667	18,937	22,655	23,544	26,488
Goats	10,046	15,581	21,693	28,647	41,166	53,787
Poultry	12,444	17,715	32,033	57,503	63,198	73,648

Punjab and Sindh are the major milk producing areas. In 2006/07, milk production was estimated at 40 million MT (Table 2-9). Even though Pakistan is the world's fifth-largest producer, the average yield per milch animal is significantly lower than its potential. Of the total milk produced, only 6 percent is processed hygienically. The rest is either consumed at home or sold through informal milkmen. Milk adulteration and unhygienic handling can pose serious health hazards.

Table 2-9
Estimated Milk Production (000 MT)

Year	Cows	Buffaloes	Sheep	Goats	Total
1997/98	9,682	19,868	30	546	30,126
2000/01	10,240	21,817	31	607	32,695
2001/02	10,437	22,527	31	629	33,624
2002/03	10,639	23,271	31	652	34,593
2003/04	10,847	24,050	31	675	35,603
2004/05	11,059	24,855	31	675	36,620
2005/06	13,407	24,723	34	664	38,828
2006/07	13,913	25,465	35	682	40,095

SOURCE - MINFAL (Livestock Wing).

The supply of red meat has also grown (Table 2-10). The current estimated annual production is a little over 2 million MT. This is in response to increased demand for better diet in the urban areas. Nonetheless, the present supply of mutton is less than the demand, and the gap is met through imports from India. In 2006/07, the poultry population was estimated at 554,000 MT. Poultry contributes about 20 percent of the country's meat production. In the same year egg production was reported as 10 million.

Table 2-10
Estimated Meat Eggs Production (000 MT)

	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07 (P)
BEEF							
Cattle	476	486	495	505	515	702	729
Buffaloes	533	549	565	582	600	742	764
Total-Beef	1,009	1,035	1,060	1,087	1,115	1,444	1,493
MUTTON							
Sheep	220	221	223	224	225	207	210
Goats	446	462	479	496	514	347	356
Total-Mutton	666	683	702	720	739	554	566
Poultry Meat	339	355	372	378	384	512	554
Total-Meat	2,014	2,073	2,134	2,185	2,238	2,515	2,618
Eggs (Million No)	7,505	7,679	7,991	8,102	8,529	9,712	10,197

P— Provisional

SOURCE MINFAL (Livestock Wing)

Fisheries Production

On average, fisheries contribute 1 percent to total GDP and 4 percent to agricultural GDP.[12] Total fish production (inland and marine) increased from 590 MT in 1996/97 to 640,000 in 2006/07. In the same year, fish and fish products valued at about US$160 million were exported from Pakistan. Data for the last ten years suggest that growth in fish has been modest, and the increase in fish catch has been mainly from increase in the marine fish production. (Table 2-11).

Forestry Production

Forests in Pakistan, as elsewhere, are a source not only of timber and firewood but also of income through non-timber forest production. Forests reduce soil erosion in the watersheds, and hence support the life of dams and waterways. In the past 30 years, the forest areas in Pakistan were denuded massively by indiscriminate legal and illegal felling and logging by locals and the Afghan refugees. This is evident in the constant decline in timber output (Table 2-12). Timber production fell from 221,000 cubic meters in 1990/91 to 116,000 cubic meters by 2006/07. Firewood extraction, which was 851,000 cubic meters in 1990/91, has declined to 717,000 cubic meters, indicating continuous pressure on the forest cover.

[12] Ibid

Table 2-11
Fish Production (000 MT)

Year	Inland	Marine	Total
1989/90	113.2	369.8	483.0
1990/91	115.9	402.8	518.7
1991/92	121.6	431.5	553.1
1992/93	122.5	499.2	621.7
1993/94	139.5	418.6	558.1
1994/95	136.4	405.5	541.9
1995/96	160.2	395.3	555.5
1996/97	167.5	422.2	589.7
1997/98	163.5	433.5	597.0
1998/99	179.8	474.4	654.2
1999/00	176.4	438.4	614.8
2000/01	178.6	451.0	629.6
2001/02	183.3	454.5	637.8
2002/03	165.7	400.5	566.2
2003/04	403.0	573.5	976.5
2004/05	174.6	406.0	580.6
2005/06	179.9	425.0	604.9
2006/07	250.0	390.0	640.0

FOOD AND AGRICULTURAL SUPPORT SYSTEM

Agricultural Marketing Systems

In Pakistan, the agricultural marketing system is predominantly a private sector activity. The provincial food departments and a parastatal, the Pakistan Storage and Supplies Corporation (PASSCO), are responsible for procuring wheat up to a target amount, after which the private sector may procure wheat. Similarly, the Trading Corporation (TCP) of Pakistan, under the federal Ministry of Commerce, on advice from the Ministry of Food, Agriculture, and Livestock (MINFAL), imports wheat, fertilizers, and occasionally other food commodities such as sugar and pulses.

At the retail/wholesale stage the factor and product markets are linked. The pivotal market functionary, the commission agent (*arhti*), acts as input supplier (dealer and wholesaler) and produce purchaser. Because the agent also provides inputs on credit to regular customers, both for production and consumption needs, farmers pay an exorbitant implicit interest rate. Though the agent is providing important services, the service charged is exploitative though justified on the basis of risk. Following is a brief description of the marketing system for farm inputs and outputs.

Table 2-12

Quantity and Value of Major Forest Products of Pakistan

Year	Timber		Firewood		Total	
	000 Cubic. meters	Million Rs	000 Cubic. meters	Million Rs	000 Cubic. meters	Million Rs
1990-91	221	128.0	851	N.A	1072	128.0
1991-92	232	391.4	259	44.5	491	435.9
1992-93	371	454.0	320	64.0	691	518.0
1993-94	187	776.5	516	71.2	703	847.7
1994-95	338	615.9	346	65.5	684	681.4
1995-96	363	615.6	357	N.A	720	615.6
1996-97	126	478.0	217	114.0	343	592.0
1997-98	184	384.0	202	54.4	386	438.4
1998-99	227	492.0	209	71.5	436	563.5
1999-00	138	660.0	226	284.9	369	944.9
2000-01	243	706.9	399	293.3	642	1000.2
2001-02	240	740.0	413	290.7	653	1031.0
2002-03	151	685.7	243	257.2	394	915.9
2003-04	150	1176.5	306	317.0	456	1493.5
2004-05	167	1283.7	523	393.2	690	1676.9
2005-06	138	1384.3	336	386.2	474	1770.5
2006-07(P)	116	1135.5	717	87.0	833	1222.5

Note - Figures are for all Pakistan excluding Northern Areas and AJK

N.A= Not available

P = Provisional (Data of Sindh, Balochistan are not available)

SOURCE Pakistan Forest Institute, Peshawar.

Input Marketing

The main inputs for the agriculture sector are seeds, fertilizer, pesticides, agricultural machinery, fuel for machinery, power for tubewells, and water. The private sector is the main supplier, save for power and canal irrigation supplies, which provincial irrigation and power departments manage and supply.

Seed

Farmers generally retain cereals seed from previous crops or purchase it from fellow farmers, wholesalers, or commission agents. Wholesalers provide seed either from the previous crop stocked by them or as dealers on behalf of seed companies—national and multinational seed companies as well as the public sector provincial seed corporation.

Both the private and public sectors are involved in seed marketing. About 600 registered private sector seed companies import or produce oilseed and vegetable seeds and market them; multinational seed companies deal mainly in hybrid seed, although recently, a national company has also started producing and marketing hybrid paddy seed.

The main public sector suppliers of processed and certified seed are Punjab Seed Corporation and Sindh Seed Corporation. Table 2-13 shows that in 2006/07, public sector organizations supplied about 163,000 MT of wheat seed, 32,000 MT of cotton seed, 12,000 MT of paddy seed, and 9,300 MT of maize seed, as well as small quantities of oilseeds and gram seed. The provincial seed corporations have a monopoly on the multiplication of improved cultivars released by the public sector research establishments, their processing, and sale to farmers. Private sector seed companies do not have access to the basic seed developed at public sector research outfits, but legislation has been proposed that would ensure that breeders can exercise intellectual property rights, and sell the developed basic seeds to both public and private sector seed processing entities.

There is a need to ensure breeders' right and unrestricted access to private seed companies. Furthermore, seed corporations should operate as commercial entities and should not be subsidized.

Table 2-13
Distribution of Improved Seed (000 Tons)

Crop	1998/99	1999/00	2000/01	2001/02	2002/03	2003/04	2004/05	2005/06	2006/07
Wheat	104.21	106.37	159.22	143.25	129.41	135.51	171.20	168.12	163.46
Paddy	2.28	3.81	2.27	4.86	4.49	7.55	9.72	12.52	11.90
Maize	0.51	2.84	2.40	2.96	4.50	5.18	5.95	9.06	9.25
Cotton	27.02	33.40	29.46	39.87	31.12	28.39	28.90	34.17	31.79
Gram	0.35	0.19	0.25	0.31	1.51	1.34	0.57	0.41	0.38
Oilseeds	0.11	0.15	0.20	0.32	0.99	0.80	1.78	1.79	1.82
Total	134.48	146.76	193.80	191.57	172.02	178.77	218.12	226.07	218.60

Fertilizers

The private sector produces and sells fertilizer, although the government imports fertilizer when supplies fall short. In 2006/07, the annual consumption of nitrogenous fertilizer was about 2.6 million nutrient tons (Table 2-14). This off-take is about 9.5 percent lower than the previous year. In the same year, about 979 thousand nutrient tons of phosphate fertilizer were used—15.1 percent higher than the previous year. The off-take of potash was only 43,000 nutrient tons, but was an increase of almost 60 percent over the previous year. To encourage balanced use of fertilizer, the government has provided a subsidy of Rs 250 per bag on diammonium phosphate (DAP). The recommended Nitrogen to Phosphate ratio is 2:1, compared to historic use of over 3 N to 1 P. In 2006/07 the ratio improved to 2.7:1. This is despite manifold increase in the price of phosphatic fertilizer. The gap between local production and consumption is filled through imports by the public and private sectors. Table 2-15 shows that Pakistan has been importing on average about 700,000 nutrient MT in a year. ***The main issues that farmers face are timely availability and adulteration. The blanket fertilizer subsidy should be replaced with a policy that directs subsidies to small and marginal farmers.***

Table 2-14

Fertilizer Consumption, 1990–2007(000 N/Tonnes, Percent Change over Previous Year)

Year	Nitrogen	% Change	Phosphate	% Change	Potash	% Change	Total	% Change	N.P. Ratio
1990/91	1471.6	(+) 0.3	388.5	(+) 1.6	32.8	(-)18.2	1892.9	(+) 0.1	3.8:1
1991/92	1462.6	(-) 0.6	398.0	(+) 2.4	23.3	(-)29.0	1883.9	(-) 0.5	3.7:1
1992/93	1635.3	(+)11.8	488.2	(+)22.7	24.1	(+) 3.4	2147.6	(+)14.0	3.4:1
1993/94	1659.4	(+) 1.5	464.2	(-) 4.9	23.2	(-) 3.7	2146.8	(-) 0.1	3.6:1
1994/95	1738.1	(+) 4.7	428.4	(-) 7.7	16.6	(-)28.4	2183.1	(+) 1.7	4.1:1
1995/96	1990.9	(+)14.5	494.4	(+)15.4	29.7	(+)78.9	2515.0	(+)15.2	4.0:1
1996/97	1985.1	(-) 0.3	419.5	(-)15.1	8.4	(-)71.7	2413.0	(-) 4.1	4.7:1
1997/98	2075.0	(+) 4.5	551.0	(+)31.5	20.0	(+)150.0	2646.0	(+) 9.7	3.8:1
1998/99	2099.0	(+) 1.2	465.0	(-)15.6	21.0	(+) 5.0	2585.0	(-) 2.3	4.5:1
1999/00	2217.0	(+) 5.6	596.0	(+)28.2	18.5	(-)13.1	2832.0	(+) 9.5	3.7:1
2000/01	2264.5	(+) 2.1	676.7	(+)13.5	22.8	(+)23.2	2964.0	(+) 4.6	3.4:1
2001/02	2285.3	(+) 0.9	624.5	(-)27.6	18.8	(-)18.0	2928.6	(-) 1.2	3.7:1
2002/03	2349.1	(+) 2.8	650.2	(+) 4.1	20.5	(+) 9.2	3019.8	(+) 3.1	3.6:1
2003/04	2526.7	(+) 7.6	673.5	(+) 3.6	21.8	(+) 6.3	3222.0	(+) 6.7	3.8:1
2004/05	2796.4	(+) 10.7	865.1	(+) 28.5	32.5	(+)49.2	3694.0	(+)14.7	3.2:1
2005/06	2926.6	(+) 4.7	850.5	(-) 1.7	27.0	(-) 16.9	3804.1	(+) 3.0	3.4:1
2006/07	2649.7	(-) 9.5	978.7	(+) 15.1	43.1	(+) 59.6	3671.5	(-) 3.5	2.7:1

Note - Minor difference may be due to rounding of figures
SOURCE National Fertilizer Development Centre (NFDC), Islamabad.

Table 2-15

Import of Fertilizers (thousand nutrient tons)

Year	N	P	K	Total
1990/91	365.0	264.0	56.0	685.0
1991/92	360.0	257.0	15.0	632.0
1992/93	393.0	357.2	8.9	759.1
1993/94	313.0	547.0	43.0	903.0
1994/95	73.0	186.0	2.0	261.0
1995/96	248.8	280.6	51.6	581.0
1996/97	472.8	381.0	24.3	878.1
1997/98	286.9	415.7	11.1	713.7
1998/99	421.8	425.0	37.2	884.8
1999/00	233.0	416.0	13.8	662.8
2000/01	194.0	369.1	16.5	579.6
2001/02	178.5	429.5	17.7	625.7
2002/03	215.7	542.4	7.9	766.0
2003/04	204.2	553.5	6.4	764.1
2004/05	309.7	458.2	16.9	784.8
2005/06	603.4	639.8	25.1	1268.3
2006/07	307.6	476.2	12.1	795.9

SOURCE National Fertilizer Development Centre, Islamabad.

Pesticide

The private sector handles pesticide formulation, manufacture, and trade; the public sector has virtually no role except for aerial sprays and locust control measures. Any approved pesticides can be formulated and produced, or imported. During 2006/07, 15,500 MT of pesticides were

imported, while 75,000 MT were locally formulated (Table 2-16). Farmers generally apply pesticides without giving consideration to the infestation level and often spray the crop unnecessarily. Similarly spraying and disposal of leftover pesticides and containers pollutes the environment. The indiscriminate use of a wide range of pesticides is creating health and environmental hazards. The extension departments in the provinces need to disseminate widely the safe, correct methods of pesticide application.

Table 2-16
Consumption of Pesticides

Year	Quantity M.T.			Value (million Rs)
	Imports	Production	Total	
1990	7502	9941	14743	4581
1991	6157	14056	20213	5536
1992	6691	16748	23439	6554
1993	6128	14151	20279	5384
1994	10693	14175	24868	5808
1995	20136	23239	43375	7274
1996	24151	19068	43219	9987
1997	24168	13836	38004	9904
1998	22765	18811	41576	6960
1999	27210	18470	45680	7324
2000	19764	41535	61299	4971
2001	20678	26914	47592	7741
2002	27103	42794	69897	6790
2003	24028	54105	78133	8138
2004	40482	89116	129598	12592
2005	28371	76792	105164	10379
2006	12721	30855	43576	5906
2007[a]	15553	75123	90676	12290

[a] Jan.–Oct.

SOURCE Agriculture Statistics of Pakistan 2006/07 Department of Plant Protection, Karachi.

Output Marketing

The private sector plays the major role in marketing of agricultural products, except for wheat, for which the public sector is the major player. Farmers of most crops, except for sugarcane, dispose of their produce through commission agents *(arhti),* who also generally act as wholesalers, through itinerant village dealers, who purchase small quantities at the farm gate. Sugarcane is sold directly to sugar mills. The commission agents and wholesalers sell wheat either to the public sector procurement centers or to flour mills directly. Most cereals are sold by wholesalers to retailers.

The price of most commodities is negotiated according to the prevalent market rates, while cottonseed price is determined as per spot rate of the day in the Cotton Exchange. Perishable commodities, particularly vegetables, are auctioned through the commission agents. Occasionally, itinerant dealers also purchase standing crops such as maize, fodder, and vegetables. The majority of orchard owners sell their standing crop to contractors, who generally are front persons for the fruit commission agents.

Contract farming is a recently introduced arrangement, but only on a limited scale. The main maize product makers negotiate a presowing contract with the maize growers. For the past few years, fruit processors and exporters have also entered into agreements with orchard owners directly, bypassing commission agents, for the supply of a given quantity of fruits at a negotiated price. More recently, the two cash-and-carry companies have also started buying vegetables and fruits from growers. *There is ample opportunity to integrate farmers, supermarkets, processors, and exporters into value chains.*

CROSS-CUTTING ISSUES

The following cross-cutting issues have a bearing on the food and agricultural system: (1) government price control of agricultural output, (2) inadequate investment in research and dissemination of technology packages to farmers; (3) Inadequate investment in related infrastructure; (4) governance; (5) outmoded legal and regulatory mechanisms; (6) environmental issues; and (7) gender issues.

Output Price Control

The government, for political exigencies, interferes in commodity prices through announcement of minimum support price (MSP) for various crops, particularly wheat and sugarcane. Historically, the MSP for wheat has been much lower than the import parity price for wheat, discouraging farmers to invest in optimal inputs for wheat cultivation. Similarly, subsidies on wheat flour also lead to misdirected benefits and exclude poor consumers who do not have access to the public sector wheat distribution outlets. Similarly, the price of sugarcane is fixed higher than the import parity price. As a result the consumers have to purchase sugar at a higher price, which otherwise could be imported at a lower price. Similarly, the district administrations occasionally fix the prices of milk, beef and mutton, vegetables, and fruits such that they are lower than the cost of production, when the supply of these commodities exceeds demand. ***The price interference thus discourages the suppliers/producers to invest in higher technology packages, and restrains the growth of commodity. Moreover, the subsidy, being misdirected, does not reach the poorer consumers.***

Investment in Research and Extension

Historically, the allocation to research and extension has not been commensurate with the sector's contribution to the GDP. It is less than 2 percent, which is significantly lower than the requirement. Moreover, the research system is not demand based, which limits the utility of research to the emerging needs of the sector. The devolution in Pakistan has further weakened the capacity to interface between research and farmers. ***There is a need to undertake institutional***

reforms to revitalize the research and extension service delivery, which is conspicuously absent.

Rural Infrastructure

The existing availability of related rural infrastructure, such as rural roads, warehouse and storage facilities, cold storage and cool chains, power, and agricultural markets, are inadequate to cope with the increasing demand for services. The present agricultural markets, particularly for perishable commodities, are inadequate. Without the upgrading and expansion, accelerating the rural non-farm economy in general, and fostering agro-based rural enterprises, value addition initiatives would be constrained for want of adequate investment, either by the public sector or under public-private-partnership arrangements. ***There is a need to support investment in expanding the rural infrastructure base to facilitate integrated value chains.***

Governance

The present level of access to factors of production, particularly timely availability of inputs to small and marginalized farmers is a severe constraint to productivity. The situation is especially less conducive for an equitable distribution of canal irrigation. Similarly, poor access to land records and title deeds limit the ability of small farmers to access credit services. Moreover, in disputes over property, records of land rights, or tenancy the redressal mechanism is cumbersome, costly, and in most cases unfavorable to the small and vulnerable. ***There is a need to reform the justice system and make the services accountable and to empower the disadvantaged, particularly women***.

Legal and Regulatory Mechanism

The existing laws and regulatory mechanisms to ensure protection from malpractices of market functionaries, such as supply of unapproved and substandard inputs, delayed payments for supplied commodities, protection against tenancy and occupiers rights, etc., are outmoded and are not enforced. The suppliers of branded inputs also feel incapable of warding off the sale of counterfeit and fake inputs.

Environmental Issues

Several environmental consequences have been identified by environmental experts, such as contamination of underground fresh water by leaching of nitrites due to improper application of nitrogenous fertilizers, indiscriminate use of pesticides and contamination of harvested food commodities with toxic pesticide residues, encroachment of brackish water into fresh water zones due to over-mining of underground brackish water into the canals, and disposal of industrial toxic waste into canals. These have severe consequences on the health of farm workers, particularly women and child farm labor, consumers, etc. ***A policy is needed to ensure environment friendly agricultural practices.***

Gender Issues

Women contribute to most farming operations, such as nursery raising, transplanting, weeding, harvesting, cutting and hauling fodder, and tending livestock. Their role is generally unaccounted for. In most areas local traditions deprive women of the right to inherit property, and even if they are allowed to inherit, they are not allowed to manage the property and access its income. In many cases, particularly in Sindh, they are not allowed to marry and are even incarcerated. ***There is a need to ensure the empowerment of women to exercise their right to inherit property and manage it.***

IMPEDIMENTS TO SECTOR PERFORMANCE

Many issues impede the private sector assuming a greater role in agriculture. The main binding factors are described below.

Pricing Policy. The government's quest to control consumer prices has been counterproductive for the producers. This, apart from misdirecting the terms of trade against agriculture, depresses the profitability and incentive to invest in the adoption of higher technology packages. The delayed announcement of minimum guaranteed price for wheat, which was significantly below the market clearing prices, and curbs on interprovincial and interdistrict mobility create artificial shortages. Similarly, controlling of prices of vegetables, milk, meat, mutton, and poultry by district administrations under section 144 also discourages the supply of these items. For strategic reserves and or operational reserves, the government should procure wheat at market prices. Similarly the issue price of wheat, which is at the procurement price, also distorts the market. The subsidy is misdirected and excludes the deserving.

Input prices are generally in the private sector domain. Nonetheless, the government provides a subsidy on fertilizers, the use of precision land leveling equipment, and electricity. This subsidy is also generally misdirected and should be limited to small and marginal farmers through the social protection instruments.

The water pricing policy is also needs attention. The current water pricing encourages inefficient use of water, is a burden on the exchequer, and results in deferred maintenance. The water pricing policy needs to be revisited to induce higher returns per unit of water.

Ineffective Service Delivery Mechanism. The public sector research and extension system is ineffective, with little communication between researchers, extension agents, and service users. The system needs to be revitalized by empowering users to determine the research agenda, fostering public-private partnerships in research and extension, and addressing duplication and overlap in the mandates of research institutions.

Governance., Poor governance (rent seeking) hampers the role of the private sector. The redress mechanism for seeking justice when contracts are broken or deals are fraudulent is weak and ineffective. An investor providing interlinking credit for input and output procurement has to assume risks of default. Similarly, credit disbursement against collateral or contract farming arrangements cannot be risked because the land titling system is antiquated and unreliable.

Rural Infrastructure. The absence of adequate rural infrastructure such as power, roads, cool chains, and warehouses impedes the fostering farm and non-farm (upstream and downstream) linkage activities.

Gender-Neutral Human Resource Development. Trained and skilled workers for on- and off-farm technology improvement are scarce in the rural areas. The curricula of existing technical training institutes are outmoded and unable to foster rural nonfarm economic activities that support value chains and value addition activities. Alongside agriculture, the rural nonfarm economy is important in the lives of rural people.

3. Irrigation

One of the world's most arid countries, Pakistan has an average annual rainfall of less than 240 mm and a system of canals, dams, and hydraulic structures that have reclaimed much of the land from desert. Pakistan also has the largest contiguous irrigated area in the world in the form of the Indus Basin Irrigation System (IBIS), devoting 95 per cent of its developed water supplies to agriculture (Mohtadullah 1997; WB2008aa). The Indus River system has an annual influx rate of 180 billion cubic meters of water, mainly from Himalayan snowmelt shared with neighboring countries (WB 2005a).The IBIS comprises

- The Indus River and its tributaries—the Jhelum, Chenab, Ravi, Beas and Sutlej;
- Three major storage reservoirs, including Tarbela the world's largest, which serves 40 percent of the population;
- 19 barrages;
- 12 inter-river link canals;
- 43 irrigation canal commands, covering 38 million acres through 63,000 kms of canals; and
- More than 110,000 watercourses delivering water to farms (WB 2008aa and 2005a).

The barrages divert water from rivers into the main canals, where the water flows to branch canals, distributaries/ minors, and watercourses supplying tertiary irrigation command areas known as *chaks* or *dehs*, via ungated outlets (*moghas)* (WB 2008a).

At independence, Pakistan had huge groundwater reserves; Punjab province alone had hundreds of billions of cubic meters of water. But with intensive irrigation in Punjab and Sindh, natural salts have risen through the desert soils to cause serious salinization and waterlogging. The country's 600,000 tubewells have increased the use of groundwater, beneficially increasing evapotranspiration and leading to a boom in agricultural productivity, but also causing overexploitation of reserves and water stress in the plains (WB 2005a and 2008a).

Pakistan's water infrastructure is now precarious as aging facilities require massive investment to be upgraded. Barrages are being rehabilitated, but new investment is needed in irrigation as well as for power, industrial, and domestic uses of water (WB 2008a). Surface and groundwater

sources are at their limit (WB 2005a). In sum, the country is facing severe water stress and resources are "overexploited" according to the most recent data (World Bank 2007).[13]

DEVELOPMENT AND THE WATER SECTOR

Pakistan's Country Assistance Strategy focuses on expanded lending for energy, water, and transport infrastructure as key to development. Infrastructure is a pressing need as 40 percent of the population lacks access to electricity and 75 percent of rural health, education, and market facilities are accessible only by earth tracks, significantly hampering agricultural growth and development (WB 2008a). Meanwhile the agricultural sector accounts for 25 percent of GDP, two-thirds of employment, and 80 percent of exports. And a full 90 percent of food production depends on the irrigation system.

The World Bank's support for the irrigation system will target institutional reforms and investments in physical systems to make the irrigation service more efficient and accountable (WB 2008a). Water sector challenges include

- Increased water stress, with limited groundwater reserves and resultant need for large surface water storage;
- Acute power shortages requiring enhanced hydropower capacity;
- Irrigation and drainage problems, including inefficient surface water delivery, low water productivity, waterlogging and salinity with resource degradation, poor operations and maintenance, and poor cost recovery resulting in poor infrastructure maintenance;
- Basin-wide water resource management issues, including water quality and environmental flows;
- Climate change; and
- Fiscal constraints on investment.

An earlier World Bank assistance strategy identified asset management and development, water resources management, irrigation service delivery, and on-farm productivity as areas needing improvement (WB 2008a).

INDUS BASIN AND CLIMATE CHANGE

The glaciers of the western Himalaya act as a reservoir for the Indus Basin, capturing snow and rain and releasing it to rivers that flow into the plains. Climate change estimates now predict 50 years of glacial retreat, after which river flows will increase. This, combined with "flashier" rainfall, will exacerbate flooding and drainage problems. Siltation will also affect infrastructure design during this period. Monsoon rainfall is expected to increase, but mostly through extreme storms. This makes the case for off-season storage even more pressing. Currently the IBIS has

[13] The water-rich regions of the north are the exception. Water stress is defined as total water use in relation to water availability, after taking into account environmental water requirements—the minimum flows needed to maintain fish and aquatic species, and for river channel maintenance, wetland flooding, and riparian vegetation (WB 2007).

only 30 days of storage capacity, a far cry from 900 days' capacity in the Colorado basin in the United States and the Murray-Darling basin in Australia. More storage capacity is needed in small forms, such as rainwater harvesting systems, as well as dams (WB 2005a).

After the 50-year period of glacial retreat and with glacial reservoirs emptied, river flows are likely to decrease by up to 40 percent in the Indus Basin. This may cause out-migration and rising food security risks. Responses to climate change should therefore include investment and re-tooling of physical infrastructure and should be adaptive, including flood and disaster preparedness for humans and animals and changes in land use (WB 2005a).

Climate change is felt systemically and locally, even in Pakistan's water-rich Northern Areas (WB 2002). As flows decrease, water use and cross-sector allocation must become more efficient. Integrated management of water resources has always been challenging but has been particularly neglected in Pakistan, where irrigation agriculture has taken priority. But as cities and small towns grow, and the population of rural areas shrinks, the need for a balanced approach to allocation has become urgent.

WATER STORAGE AND HYDROPOWER

Water availability in the IBIS is highly seasonal—85 percent of annual river flows occur from June to September—so storage is critical for *rabi* (winter) and *kharif* (summer) crop seasons. The main staple crop of wheat is grown in winter, and other cash crops such as cotton, rice, and sugarcane are grown in summer. So far, siltation from river flows has decreased the capacity of Pakistan's reservoirs by 27 percent, with a 57 percent decline expected by 2025. The Government of Pakistan estimates that meeting the country's water needs will require adding 18 million acre feet (MAF) to double storage capacity (WB 2008a).

To increase power generation, the government plans large investments in hydropower, including multipurpose storage and cost sharing with other sectors such as irrigation, domestic water use, flood management, and environment. At present, Pakistan has used only 15 percent of its estimated 40,000 MW of economically viable potential in hydropower; India and China both use 30 percent and developed countries use 75 percent (WB 2008a).

As mentioned, surface and groundwater sources are at their limit in Pakistan. The country's dependence on groundwater for agriculture is high relative to other countries—more than 20 percent of irrigated area—and is exceeded only by Saudi Arabia, Bangladesh, and Yemen (WB 2007). Where groundwater is essential for poor farmers, the regulatory framework must address the relationship of groundwater entitlements to surface water rights and actual surface water deliveries by involving users in groundwater monitoring and "social recharge" (i.e., voluntary self-regulation) (Usman Qamar in WB 2005b). Groundwater management, like water management generally, is inextricably linked to formal and informal water allocation and rights regimes (Table 3-1). Hence it is important to consider not only regulations and policy, but also informal entitlements given the fact of overlapping rights regimes or "legal pluralism" (Kuriakose et al 2005).

Table 3-1
Institutional Framework for Groundwater Management

Institutional Framework	Management Instruments	Results
Formal institutional arrangements (groundwater laws, decrees) Informal water institutions (sociocultural norms, religious precepts) Other institutions indirectly affecting groundwater management (e.g., energy policies)	Groundwater use rights Pricing Information Water user participation	Groundwater allocation and use (quantity and quality)

SOURCE Kemper 2003.

WATER QUALITY

Water quality is a serious issue in Pakistan. Pesticides, fertilizers, untreated urban wastewater, and industrial effluents are polluting surface water and groundwater on a large scale (WB 2005a). In fact, econometric analysis of productivity data over time and across districts in Punjab shows soil and water pollution may have negated the gains expected from the use of Green Revolution seed varieties and technology, calling into question high-input approaches to agricultural development (WB 2007). More than 90 percent of untreated and often toxic municipal and industrial wastes are dumped in open drains leaching to aquifers (WB 2005a). And the country has only one industrial common effluent treatment plant. At the urging of nongovernmental organizations such as the WWF, some firms are monitoring their output of pollutants, but without regulatory enforcement and proper incentives the problem grows daily and continues to affect domestic use and food safety (and hence farm income) in horticultural production, particularly in peri-urban areas. At the system level, irrigation canal water flows from sources several hundred kilometers away become polluted during transmission. Villagers contribute to local contamination by using watercourses for washing and bathing. These same watercourses then feed directly into village water tanks used for drinking water and other purposes.

WATER AND AGRICULTURE IN THE PROVINCES

Punjab and Sindh

The provinces of Punjab and Sindh are the heart of Pakistan's irrigated rice and wheat production. This production, however, takes place on land reclaimed from the Thar Desert. The region's groundwater is highly saline and residents depend on canal irrigation water for other water needs, including drinking. The highly structured canal systems supply distributaries on a rotational "on-off" basis, resulting in water shortages in certain parts of the system and oversupply in others. Studies by the International Water Management Institute (IWMI) found that up to 58 percent of farmers reported keeping part of their agricultural land fallow because water is scarce. This is echoed in water productivity statistics, with crop yields in Punjab, Pakistan half that of Punjab, India due to poor quality water services in Pakistan (WB 2005a). Yields from self-provided groundwater are twice that of areas relying on inflexible and unreliable canal supplies (WB 2005a).

Balochistan

Balochistan covers 44 percent of the country's area but has a population of only 7.8 million (5% of total population) (WB 2008b). Forty-seven percent of households live below the official poverty line compared to 32 percent nationally. Particularly dry, the province—including the Pishin Lora Basin in northwest Balochistan—has been suffering from drought since 1997. The drought, along with ongoing deforestation and overgrazing, has eroded soil, made wildlife very vulnerable, and made water very scarce (WB 2008b). As surface water declined, rangelands degraded and agricultural activities declined despite growing use of groundwater. In the arid *barani* (rainfed areas), farmers pump water from hundred of meters depth (WB 2005a). The provincial government subsidizes groundwater pumping through low electricity tariffs, in contrast to other provinces, such as Sindh where only public well pumping is subsidized (WB 2005a). But even groundwater reserves are proving insufficient, and water shortages are spurring out-migration by poor households (WB 2008b).

Northwest Frontier Province, Azad Jammu and Kashmir, and Northern Areas

Most irrigation in hilly and mountainous areas is in the form of gravity-fed, glacier melt irrigation canals (e.g., *karez* in Balochistan[14]). Traditional forms of management have grown up around these canals, with communities providing collective labor for annual canal cleaning and new construction. The *warabandi* system of fixed turn systems operates in low-lying areas of Punjab and Sindh through formal organizations and informal user groups. Formal WUAs are often organized by government or NGOs, while the latter are indigenous institutions with strong normative grounding. This distinction between formal and informal can be misleading in some places, as formal organizations often grew from the indigenous (e.g., village organizations supported by the Aga Khan Rural Support Program in the Northern Areas). Traditional means of accessing water may be more effective in areas with a long history of farmer-managed irrigation (e.g., in the hills and mountains) than in areas where irrigation is relatively new (e.g., the semi-arid plains of Punjab where irrigation infrastructure dates only from the 1930s). In addition, because landholdings are larger and less equitably distributed on the plains than in mountainous areas, social inequalities probably pose greater obstacles to collective action.

WATER POLICIES AND INSTITUTIONS

Irrigation, water supply, and sanitation services in Pakistan are delivered mainly through large public enterprises operating with little user oversight or input. Attaining accountability, transparency, and financial sustainability will require that new community and user associations enter the sector, as well as small and large private operators, using clear entitlements, benchmarking, and transparent rules for operation. Some decentralization has already taken place; Punjab and Sindh have undertaken reforms to decentralize irrigation management and improve user participation, including clear entitlements. These two provinces together manage more than

[14] *Karez* are tunneled or underground channels that tap aquifers or springs.

85 percent of the IBIS. The WB plans to help extend such reforms into NWFP and Balochistan (WB 2008a).

Water Pricing and Rights

National agricultural water policy covers water law, rights, pricing, and allocation; user participation; subsidy policy; and asset and management transfer of infrastructure as in Irrigation Management Transfer (IMT). Recent reforms have put more emphasis on economic valuation of water resources, though valuation has proved difficult.

Approaches to water use efficiency must incorporate social and environmental externalities (Perry 2005), but economic water models have had difficulty in assigning values to the environmental and so-called nonproductive (i.e., non-crop) uses of water central to rural livelihoods. Water pricing in the agricultural sector has proven to be economically complex and socially and politically sensitive. In addition, economic models do not fully capture environmental and social costs and rarely consider the extractive and *in situ* values of the resource base itself. But one must recognize the growth versus equity and sustainability tradeoffs inherent in pricing regimes and the feasibility of a gradual or targeted approach. Such an approach may include block tariffs and may consider beneficiaries' willingness to pay different types of charges based on water use. Water policy can only be implemented through laws and regulations. Water allocation, taking into account geographical distribution and generational concerns, remains a primary issue at the national, basin, distributary, and field-plot levels. For example, common property and intergenerational use—particularly for groundwater—cannot be managed through market mechanisms only but require regulation (Perry 2005).

All of Pakistan's major cities except Islamabad and Karachi rely on tubewells tapping local aquifers for their raw water supply (WB 2005). Domestic water demand is expected to more than triple from 4 percent to 15 percent of water used by 2025 (WB 2005). The political economy of reform remains a challenge at all levels, from interregional and interprovincial allocations to intersector divisions as in the case of the urban and small town versus rural divide.

Multiple Uses of Irrigation Water

Poor households use and re-use water from multiple and conjunctive sources for many purposes: irrigation, drinking, livestock, industrial applications, sanitation, recreation. They use multiple sources simultaneously, depending on their suitability (easy accessibility, year-round availability, site, quality or predictability). Water agencies, however, tend to give irrigation priority. Hence users have attempted to transform single-use planned systems into *de facto* multi-use systems. Responsive irrigation projects have taken an "irrigation-plus" approach by, for example, adding washing steps or entry points for cattle, or special abstractions and reservoirs for domestic and livestock watering, especially in the dry season (Van Koppen and Kuriakose 2008).

Urbanization requires reallocating water from agriculture to industry, energy, and urban consumption (Vermillion and Merrey 1998). In this context, decisions about intersector allocation are pressing, especially when small industry and domestic users siphon water without charge, since such uses are not officially recognized and therefore not on the scheduled list for rotation or

charge.[15] Despite the evidence of integration of water uses at the local level, there are few "multiple-use water organizations." Globally, formal water sector groups have organized around single-use purposes (e.g., sanitation *or* irrigation). Alternatives to organizing on the basis of single-sector interests include a supra-organizational platform for negotiation by separate user groups, or a multi-user organization with a diverse membership (Steins and Edwards 1999; Meinzen-Dick and Bakker 1999).

Irrigation Management Transfer and Water User Associations

Using irrigation management transfer programs to decentralize governance works best when the law defines users' rights and responsibilities and thereby enhances their capacity to manage programs, particularly at the tertiary level (WB 2007). Water user associations (WUAs), particularly for surface water irrigation systems in Punjab and Sindh and as implemented by the IWMI, are extensive in Pakistan. There has been no integration of functions of WUAs across "water for agriculture" and "water for people" sectors. The private sector is not much involved, though households have invested in groundwater pumps (especially in Baluchistan); most irrigation investments are made by the public sector. Some small-scale investment has taken place with the help of NGOs such as AKRSP and TRDP.

POVERTY AND SOCIAL FACTORS IN WATER INVESTMENT

Impact of Irrigation Investment on Poverty

Investing in irrigation reduces poverty by increasing food output, raising demand for agricultural labor, and generating higher incomes than rain-fed agriculture alone (WB 2008c)—especially when land ownership is less stratified. One study showed pro-poor gains from investment to be larger in Sri Lanka than the plains provinces of Pakistan (IWMI 2005). This is because Pakistan has relatively large farms (4.3 hectares on average), skewed land ownership (Gini co-efficient of 0.51), low productivity ($448 ha.), high landlessness (28 percent), and a very high incidence of poverty (52 percent) leading to skewed benefits in irrigation gains (WB 2008c).

The effect of investment on poverty depends largely on how water availability affects demand for agricultural labor (e.g., by the landless and landpoor) by increasing agricultural intensity and the area under cultivation (WB 2005). Further, high-value crops such as spices, cotton, and groundnut produce more employment per drop of water than traditional crops (WB 2005). Women benefit directly through crop-based income (though questions remain as to who controls this income) and indirectly through irrigation-driven agricultural employment that reduces rural out-migration.[16] One may quantify the indirect multiplier effects on women's contribution to

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[15] Where official allocations do not plan for untraditional rural uses, stakeholders will resort to other less sustainable methods to access water. After being denied official sanction to use surface water, hotels in rural Sri Lanka turned to groundwater extraction (Meinzen-Dick and Bakker 1999, p. 288).

[16] World Bank irrigation projects in Northeast Brazil and northern India led to "high quality, permanent" jobs in Brazil and higher daily labor rates in India (WB 2003 in Kuriakose et al 2005: 4).

economies at different scales through, for example, gender-disaggregated input-output or social accounting matrices, or CGE models.[17]

To reduce inequality in tertiary level water allocation, projects must take into the account the needs of poor farmers and other water users by monitoring how WUA membership is allocated and how the WUAs are run, by addressing multiple-use issues, and by integrating agricultural extension and credit outreach services to tenants and women. Bundling marketing, extension, and financial services outreach with water services is particularly effective.[18]

To be successful, such initiatives must also support the development of local suppliers, taking into account the production and distribution of low-cost equipment, market outlets, individual farmers' technical knowledge and management capacity, and the organizational capacity of WUAs. Projects to increase horticultural production and the production of other nontraditional crops should also define target groups in a transparent way, and consider the sex-disaggregated labor impacts of increased production, processing, and marketing in local areas. Feasibility studies should also estimate the number and proportion of farms in the command area that will be lifted above the poverty line through projects. Methods for enhancing the pro-poor impacts of irrigation projects include

- Targeting the tail-enders (irrigation systems) and the smaller "irrigation units" run by poorer farmers;
- Directing appropriate technology to upgrade the production systems of the poor (e.g. low-cost tools easily maintained by local mechanics);
- Targeting the poorest areas of the country;
- Targeting the upland areas/ upper watershed in an integrated basin project; and
- Targeting small farms through a ceiling on hectarage and a sliding scale of subsidy (WB 2008c).

Future USAID programming should identify its objectives and approach to pro-poor development outcomes, as appropriate, particularly given the severe land stratification in much of Pakistan.

Gender, Social Exclusion, and Access to Water

To achieve equity and prevent conflict, spatial and physical models of water scarcity must be viewed through a socioeconomic lens. It is important to "lay" the print of village, town, and region over that of watercourse, distributary, and canal to ensure that socioeconomic as well as hydrological points of reference are considered.

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[17] Such disaggregation can yield meaningful results. Irrigation can raise demand for female agricultural wage labor (World Bank Uttar Pradesh Sodic Lands project). Having more water available can lead to increases in girl's educational participation, can free women to do more than gather water, can improve women's health, increase the yields of women's plots, etc.

[18] BASIX, a financial institution in India, collaborates with NGOS to support motor pumps for small-scale irrigation in Andhra Pradesh (www.basixindia.com).

Irrigation managers have for some time considered spatial inequity in relation to physical structure (i.e., head versus tail users), but inequitable access due to tenancy, gender, or other socioeconomic factors is less frequently considered (see sidebar). WUAs are helping to resolve water distribution issues for upstream and downstream users, but inequitable access due to social status is less easily overcome. For example, timely access to canal irrigation water of adequate amount and quality is of paramount importance to rural farm households, but women may have irrigation preferences, depending on the gender division of labor in the local cropping system.[19]

In Punjab, a tenant's right to join a WUA depends on the tenancy. Permanent tenants long associated with a certain plot of land are often delegated a right to membership, though this remains the prerogative of the landlord and is thus vulnerable to manipulation. Tenants with annual arrangements do not join as a long-term institutional arrangement is not compatible with their rapid turnover. Spatial settlement patterns also matter for inclusion in WUAs. For example, residents of an "additional settlement" on the outskirts of a village in Punjab had to organize their own formal WUA when the village farmers barred them from joining theirs. The new FO then forced the village FO to allocate water fairly between the two parts of the village (Kuriakose et al, forthcoming).

Water Access and Social Stratification

Colonial irrigation in Punjab in the 1930s was constructed on a grid pattern. Settlement patterns today approximate social stratification. The dominant agricultural castes (and the numerical majority) live in the village center near the diggi tank, while lower castes live in "additional settlements" adjacent to the village but outside its walls. This spatial and social division creates conflicts over water. Water is allocated for agriculture according to the acreage to be irrigated. However, only the land of those residing in the village is counted for water allocation. Those in the additional settlements have no right to irrigation water, even if they own land.

SMALL-SCALE IRRIGATION AND DRAINAGE

Pakistan's small-scale and traditional irrigation systems range from spring-fed and shallow-well systems, to elaborate groundwater conveyance systems such as the *karezes* of Balochistan, as well as water harvesting systems (*khukaba* and *saliaba* systems) and small-scale storage for kitchen gardens and the like (WB 2006). Participatory approaches to drainage investments have also worked well and sorely need additional support in Pakistan. The Mardan Salinity Control and Reclamation Project had a significant positive impact, increasing crop yield by 27 to 150 percent over a one-year period (WB 2006). The Salinity Control and Reclamation Projects (SCARP) were initially successful in maintaining the groundwater table levels and expanding conjunctive use of surface and groundwater sources in the area, though performance of the tubewells has been declining over time. Public tubewells have been turned over to community management during the past decade, and with World Bank support, transferred to the private sector.

[19] An IWMI Pakistan study found that 87 per cent of women are directly involved in field agriculture, with the rest contributing indirectly through labor supervision and post-harvest processing (Basnet 1992 in Zwarteveen 1993). In Nepal, for example, women tried to increase paddy ponding depth to reduce their own required labor input for weeding the paddy plants (Zwarteveen and Neupane 1997).

Watershed management has also been proven a sustainable approach to conservation and livelihood development the world over. In areas such as Balochistan—already suffering from deforestation, loss of vegetative cover, water shortages, and soil erosion—community watershed management programs have much to offer. Watershed management programs supported by the World Bank in India and the Middle East comprise water harvesting, groundwater recharge, environmental protection, and vegetative cover, and the development of viable agricultural systems for improved rural incomes. Win-win approaches such as fruit tree plantation that improve income (including among women provided they are given title, even as a collective user group) and soil and water conservation are the most viable as they provide incentives for continued local participation (WB 2006). Wastewater reuse is a related option here.

SMALL-SCALE TECHNOLOGY: WATER AND POWER

Irrigation Channels

For centuries, local communities in the hilly areas of Pakistan have built and managed small irrigation channels fed by mountain streams. Modern engineering by such organizations as the Aga Khan Rural Support Program (AKRSP) has scaled up these channels.[20] Though communities contribute labor and financing to the projects, the 70 percent rate of subsidy is higher than subsidy rates for other infrastructure projects, such as roads (50 percent) (WB 2002).

A key element of AKRSP's approach is attention to social organization and participatory planning. Still, although only 4 percent of the program's projects are abandoned or never completed, the reasons for abandonment are mainly social, such as disagreements over rights of way, compensation, allocation, and the like related to channel construction. In addition, related investments are not always well sequenced. A World Bank evaluation of the AKRSP found that some communities could not use irrigation channels immediately after construction because other land development required—such as reclamation or leveling—had not yet been done (WB 2002).[21]

The Pakistan Poverty Alleviation Fund (PPAF) funded by the World Bank has supported physical infrastructure projects through local NGOs taking a community mobilization approach (WB 2005c). Projects averaged $10,000, with communities contributing 20 percent of the capital cost (see Table 3-2).

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[20] AKRSP's irrigation projects have focused on provision of feeder channels with pipe irrigation (980 of 1,119 irrigation projects since inception), with some projects on lift irrigation, storage reservoirs, siphon irrigation, sedimentation tanks, and channeling of rivers (WB 2002).

[21] The OED evaluation by the World Bank specifies the following aspects that held up development, particularly as these aspects were handed over to villagers without additional technical assistance: development of tertiary channels; rock clearing; terrace construction; and planting (WB 2002). In some cases, difficulty topography and engineering challenges may have overwhelmed indigenous knowledge and capacity (see also Khwaja for a related discussion).

Table 3-2
Cost-Benefit Analysis of Select PPAF Projects, 2001-2004

Community Productive Infrastructure	Benefit Cost (12%)	FRR[a]	Benefit Cost (12%)	ERR[b]
TARAQEE FOUNDATION (TF), BALOCHISTAN				
TF-1 Kareze Rehabilitation and Water Storage Reservoir	1.5	25%	1.6	27%
TF-2 Watercourse Lining	2.3	39%	2.0	33%
TF-3 Watercourse Lining	2.7	47%	3.5	59%
TF-4 Watercourse Lining	1.7	29%	2.1	37%
NATIONAL RURAL SUPPORT PROGRAM (NRSP), BADIN, SINDH				
NRSP Basin 2 Watercourse Lining	1.9	32%	2.0	34%
NRSP Basin 3 Watercourse Lining	3.8	57%	2.2	44%
NRSP Basin 4 Link Road	1.3	22%	1.1	16%
NRSP Basin 5 Tubewell lift irrigation for agriculture	1.7	34%	1.3	26%

[a] *Financial rate of return*
[b] *Economic rate of return*
SOURCE *World Bank 2005c.*

Microhydels

The AKRSP has had great success in developing microhydel schemes across mountainous areas in northern Pakistan. These initiatives are financed mainly by grants, with some community contribution, and total costs per scheme average about US$$10,600 or $150 per household served (WB 2002). As water supply is plentiful in the area, microhydels are an obvious choice for small-scale power generation. They are compatible with irrigation since power generation reduces only the head and not the total water volume, meaning that the irrigation command area does not have to be reduced (WB 2002). By using simple, robust technology suited to the area, AKRSP has found a cost-efficient approach that is easily replicated, and one in which local operators, site supervisors, and villagers can be trained (WB 2002).

A local microhydel service industry and input suppliers have sprung up, designs have been refined and improved from the start of the schemes in the mid-90s to the time of evaluation around 2001-2002, and the schemes have won international recognition and been replicated in IFAD's Chitral Agricultural Development Project (WB 2002). They are used for lighting (in place of kerosene) with new demand for power for heating and cooking, agricultural processing, small business, and even community washing stations and low-wattage water heating for off-peak use. Lessons learned include the need for: (1) tariffs that meet the costs of operation and maintenance of irrigation infrastructure (rather than uneconomic flat rate charges) and that allow for the establishment of financial reserves for larger repairs; (2) adequate water flow metering provision, and (3) attention to equitable coverage and charging of all infrastructure user households (ibid)

Drip Irrigation

Drip irrigation delivers water directly to plant roots, with yield gains nearly double the average yields. Water is conserved as little is lost to evaporation or seepage, though of course groundwater recharge is also curtailed. USAID has already funded a $1.3 billion project for drip irrigation in Pakistan.[22] A pilot program near Faisalabad Punjab focused on such crops as onions, summer fodder, and cotton, with plans to expand to orchard cultivation. The PPAF has a community funding provision for drip irrigation kits in water-deficit areas, mainly for horticultural crops, and requires a community contribution of 20 percent to enhance local ownership. Social enterprise funds such as Acumen Fund in New York have also teamed up with such implementers as the Thar Rural Development Program to fund drip irrigation kits the Thar Desert of Sindh.

DONOR PROGRAMS

Donors supporting irrigation in Pakistan include the World Bank, Asian Development Bank (ADB), DFID, and The Netherlands. In 2008, the World Bank approved a $38 million grant to Pakistan for FY09-FY13 to cover capacity-building and to support federal institutions in water resources planning and management (including human resource development); hydropower planning; the upgrading of modeling and management systems and databases; and the conduct of a sediment study for the Indus system, including a study of the basin-wide impact of flushing sediment through the Tarbela Reservoir.

Under the grant's regulation, policy, and planning component, work will include studies on water resources regulation, policy, and planning; stakeholder benefit-sharing; action plans for asset development, ownership, and operation including potential interprovincial assets, public-private partnerships; enhanced institutional regimes for benefit sharing across administrative levels (i.e., local, provincial, and national); lessons learned on resettlement; environmental and social assessments at basin level; climate change impacts on Indus hydrology, water availability and infrastructure development; studies on water use productivity and irrigation efficiency; and knowledge sharing on groundwater and conjunctive use (WB 2008a). Training in system planning and management, mainly through the Water and Power Development Authority, will cover GIS and modeling efforts, including optimization models for the basin (WB 2008a).

Most of this work will be basin-wide and analytical so there is considerable scope for USAID's planned investments in small-scale irrigation and micro-hydels, given the resource scarcity in the region.

SUMMARY OF FINDINGS

We note seven main findings about Pakistan's water sector:

1. Water is underpriced.
2. Waterlogging and salinization threaten agriculture in Punjab and Sindh.
3. Groundwater mining is a serious and time-sensitive issue.

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[22] See Asia Water Wire 2008.

4. Capacity to manage Indus water is limited.[23]
5. Water shortages are looming.
6. Some managerial innovations hold real promise.
7. Government intervention is required to enforce rights.

Water is inefficiently allocated and used because water tariffs do not reflect the scarcity value of the resource. At the system level, multiple uses, particularly of canal irrigation water are not considered. At the farm level, water is squandered by poor practices, such as failure to use canal lining or water-sparing innovations such as drip irrigation, and by ill-informed crop choices. Sugarcane, for example, is twice as water-intensive as rice and four times as intensive as wheat. In contrast, with market channel support and value chain development, vegetables can be high-value production choices indeed.

Even without climate change, looming water shortages threaten the economy and polity. The need for more storage capacity and highly efficient water management and allocation is urgent. In this regard, irrigation management transfer and other local innovations showed promise in the 1990s. Reforms at mid- and macro-level (i.e., canal command level) can benefit from review and sharing of lessons learned. The excesses of both administrative and market-based allocation could be overcome by collective action regimes, indigenous and formal. But even with these reforms, government intervention is still required to enforce water rights and to create the institutional and legal framework necessary to realize the potential of transfer and exchange (Dinar et al 1997; Loza 1997). A combination of all three forms of allocation—administrative, market and collective—may be appropriate in different contexts, particularly given regional differences in physical scale, legal environment, and social stratification.

RECOMMENDATIONS

We offer recommendations for national water investment and institution building and for local interventions. We then suggest program approaches and design principles for USAID assistance to small-scale irrigation in Pakistan.

- ***National***
  - — Acknowledge the need to improve basin modeling and system design capacity to address flow variability, and invest in new infrastructure.
  - — Assemble a panel of stakeholders to consider pragmatic reforms in governance and regulation of water management, including achieving transparency in water entitlements and their administration from the interprovincial level to the user level.
  - — Develop capacity for river basin management, basin modeling, and socioeconomic analysis of water basin planning by supporting graduate training, secondments, study tours, etc.

[23] A hydro-economic model of the system is required. Basin modeling and system design capacity is particularly important now given the erratic impact of climate change. For example, during 50 years of glacial retreat, river flows will increase and rainfall will get “flashier,” heightening flooding risks and drainage problems. After this period, the glacial reservoirs will be empty, leading to huge decreases in river flows (30-40 percent in 100 years’ time) out-migration and loss of livelihood.

- ***Local/ Provincial Interventions***
  - — Direct subsidies to technological interventions, such as drip irrigation or micro-hydel investments rather than large-scale infrastructure. [24] Complement with focused extension efforts and development of an integrated value chain and business development services.
  - — Support continued development of WUAs below the distributary level and public-private partnerships at the canal command level to make irrigation service delivery more competitive, accountable, and efficient.[25]
  - — Undertake further investigation on institutional approaches to groundwater management (e.g., both government enforcement, and local WUA monitoring) to develop a program of technical support to address sustainable groundwater management. Here, the experience of Mexico, Bangladesh, India, and Nepal with groundwater management can be instructive.
- ***Opportunities for USAID Assistance.*** To improve small-scale irrigation in Pakistan, USAID should consider supporting, promoting, or aiming for
  - — Irrigation management transfer reforms.
  - — The bundling of water, agricultural extension, and financial services.
  - — Pilot initiatives for private sector financing of small-scale irrigation.
  - — Nonagricultural uses of irrigation water (i.e., multiple uses).
  - — Parallel development of water and small-scale energy, including micro-hydels for electrification (including agricultural processing) and pumpset operation in hilly areas.
  - — Improved equity and pro-poor outcomes for women and landpoor men.
  - — Mainstreaming groundwater management concerns in the IWRM, particularly in Balochistan, Sindh, and Punjab.
  - — Participatory design to focus on environmental issues, such as soil and water quality.
  - — Research on role of small towns in rural areas and implications for water management (focusing on intersectoral water allocation issues including domestic/ industrial versus agricultural uses; wastewater management and reuse; and development of irrigation equipment/ pumpset input supplier industry, including manufacturing and leasing intermediaries).
  - — Monitor waterlogging and salinity rather than intervening directly, as these problems are already being addressed by other donor projects.

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[24] Multipurpose hydropower infrastructure, including small run-of-river operations, and micro-hydels, can have myriad benefits, particularly in hilly areas.

[25] Dams and barrages (i.e. bulk infrastructure) could remain in state hands given scale efficiencies, but power plan operation could be concessions to private operators, and similarly for the drainage infrastructure (WB 2005a).

4. Value Chains

A value chain is the sequence of business activities by which, from the perspective of the end user, value is added to products or services.[26] This chapter analyzes the food supply and value chains for wheat, rice, maize, and oilseeds in Pakistan and briefly discusses the livestock, potato, vegetables, fruit, edible nuts, and the ornamental sectors as well. Meeting the challenges described herein will require reorienting the agriculture sector to growth, efficiency, and sound incentives. This will require the government to create an environment that facilitates the new orientation. Programming recommendations at the end of this chapter should be verified with further analysis. Information on supply and value chains based on government statistics is indicative of trends; however, detailed information will develop naturally in the implementation of any program in this area.[27]

CONTEXT

The agricultural sector comprises the public sector, entrepreneurs and investors, commercial growers, NGOs, the informal sector, and bilateral and multilateral donors. The Government of Pakistan wants to balance inequities in urban/rural food consumption by raising sector productivity. Sector imbalances are rooted in weaknesses in land tenure and property rights, water access, rural literacy, and gender status. These weaknesses partially stem from limited vision and consensus and the habit of approaching problems without a strategic perspective. The result is a national agriculture policy that is not market oriented and discourages foreign investment. For example, public agencies distort the market by setting domestic commodity prices or by producing or dealing in the market.

Although the public sector controls the sector's direction, the private sector dominates crop inputs, production, processing and trade. Research and development in seed, fertilizer, and plant

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[26] http://dictionary.bnet.com/definition/value+chain.html

[27] This chapter presents the results of a fact finding study that took place in Faisalabad and Lahore in Punjab Province and Karachi in Sindh Province in September 2008. We interviewed entrepreneurs, medium sized and absentee farmers, and representatives from possible government agency counterparts and private and nongovernmental organizations in a wide variety of sectors, including agriculture, water, forestry, and natural resources. Interview findings were cross referenced with background documents, discussions with USAID and Competitiveness Support Fund representatives, and other sources in Islamabad. The scope of the study did not permit discussions with the ministries of commerce, trade, finance, and education or their offices in Punjab or Sindh Provinces, or authorities in charge of irrigation and water supply.

protection are accomplished elsewhere as Pakistan has only limited intellectual property (IP) protection and plant breeder's rights (PBR). Most crops are grown by private producers. The ineffective extension services of Provincial Departments of Agriculture mean that any farmer extension services are private, and commodity trade is mostly accomplished via private markets.

Pakistan has good entrepreneurial capacity, even in the agriculture sector. Entrepreneurs and investors would like to expand operations or enter a mechanical-biological oriented business at the level of multinational, national, or family enterprise. Agribusinesses—some of which have failed for lack capacity and vision—want to take an integrated approach wherein the industry has some leaders and some followers. Banking, legal, accountancy, and transport services are in place, but need to reduce transaction costs while strengthening professional ethics and performance. The educational system needs to offer training in practical, needed skills, and management styles are too hierarchical. Meanwhile, large firms dominate national agribusiness associations, which could benefit from much broader participation.

Commercial growers would like (1) higher on-farm income, which would raise the disposable income of rural workers; (2) to make land ownership more possible and long-term leases more available to enable investment in agricultural productivity; and (3) to minimize the practice of annual share cropping. Growers are concerned about many issues not yet addressed by policymakers or donors: crop diversification and intensification; female productivity; rural finance; agro-ecological zones with land classification and enforcement; irrigation systems and water pricing; and all-weather roads.

Assistance is needed to resolve land tenure disputes, to raise literacy in rural areas, to raise rural productivity, to advance legal and regulatory reform in land titling and leasing, to resolve tenant-landlord conflicts, and to devise options for squatters and the landless. Clearly, interventions can address a wide range of stakeholder concerns. First, however, donors need to impress upon the Government of Pakistan the benefits of a commercial, market-driven agriculture system, how international trade in agriculture can benefit the country as a whole, and the importance of truthfully labeled, quality assured inputs and outputs. In turn, donors should coordinate interventions to stretch resources and to maintain balance in areas difficult to change. They should engage the government, not merely bypass it in directing funds to NGOs. Encouragingly, the government has funded agriculture programs from its own budget. The government needs to clarify roles for the public, private sectors growers, NGOs, and informal sector stakeholders taking into account the long run impacts it may have in the sector.

VALUE CHAIN POTENTIAL

In this context, some crop producers and value chain drivers are effective in Pakistan (Table 4-1). Crops attractive to the private sector are wheat, oilseed, pulse, legumes, and potato. Others can be attractive if they are distinct or have value added. Unfortunately planners and policymakers do not know how to make this happen and mixed signals from the government cause crops that could be easily produced in Pakistan to be imported. Good agribusiness opportunities in groundnuts, pulses and potatoes need supply chain drivers—first movers—to build momentum. For example, soybean production may become attractive once the benefits of PBR legislation are realized. ***We recommend a complete examination of the farming system, including the creation of***

opportunities to link commercial growers and supply chain drivers and finding ways to stimulate drivers to act first.

Table 4-1
Crop Marketing Potential

Crop	Volume	Unit Value	Repeat Sale	Direct Margin	Private Sector Attractiveness	Supply Chain Drivers, needed in
Wheat	High	Low / Medium	Medium	Reasonable	High, if product differentiation into bread & durum;	Storage, milling, retail products
Rice	High	Low	Low / medium	Low; margins critical in the long term	very low to medium; High, if product differentiation into basmati & plain rice.	Medium to high interest in milling; domestic & export trade
Maize	Medium	High	Medium	Reasonable – based on product	Medium, for feed milling	Flakes,
Oilseeds	Medium / high	Medium - high	Medium / high	Medium - high	supply chain yet to be developed	Oilseed crushers & contract growing give good prospects for oil & meal
Groundnut	High	Low	Low; medium to high if a supply chain initiator	Low	Unattractive, unless produced for a designated processor	Processing options are interesting: peanut butter; meal (protein source); oil; domestic & export markets
Soybean	High	Low - medium	High	Medium	Crop now in decline, no supply chain driver Expect high attractiveness with PBR; &	Oilseed crusher, feed mill; edible oil.
Pulse / legumes	High	Low	Low / medium	Low - medium	Good commodity exports for mung bean; cow pea; alfalfa	Modern dhal milling; contract growing to secure crops
Potato	High	Low / medium	high	medium	Very attractive for chips;	Cold store / infrastructure investments needed

Successful supply and value chains have several characteristics: their business activities adapt to changing conditions; their players are willing to partner; and potential partners are prepared to adopt a 'win-win' strategy. In Pakistan, USAID can work in the existing supply chains—which include non-market oriented players like PASSCO and provincial food departments, as well as sales-oriented small businesses—or can help develop new ones. ACIAR and AusAID, for example, are strengthening the mango supply chains. Creating and supporting the development of chains requires identifying who may conceive and form them; deciding on long-term capital investment; deciding whether to lease, trade or own land; contacting commercial commodity growers and entering agreements with the supply chain driver based on mutually agreed quality assurance; coming to grips with the logistics of production locations; and providing viable human resource development and training for supply chain members.

The rice seed/crop supply chain (Figure 4-1) is a typical agricultural chain. Commercial rice is planted using seed, fertilizer, and crop protections inputs. Crops are harvested by hand or machine, transported in sacks or in bulk to a parboiling factory, transported to a rice mill or rice noodle processing plant where the manufacturer segregates the product into end products, then

sent to domestic outlets or exported. Newer parts of the chain in Pakistan include preservation and product segregation, and the chain could benefit from information technology and verification of quality assurance and accreditation from service providers.

Figure 4-1
Rice Supply /Value Chains in Agriculture Production

Traceability allows isolation of contaminated ingredients							
PROCESS FLOW ➔							
Crop production input developer (seed; fertilizer; crop protection; agricultural mechanization; water management).	**Agricultural input dealer** – who supplies:	**Producer rice paddy (grain) lots**	**Warehouse paddy (grain) lots**	**Rice Mill lots**. E.g. differing varieties; types – e.g. Basmati chain; paddy chain	Wholesaler	Retailer	Consumer
Seed enterprise	Seed	Producer #1	Store #1	Sample #1	➔	➔	➔
Fertilizer producer	Fertilizer	Producer #2	Store #1	Sample #1	➔	➔	➔
Crop protection developer	Crop protection	Producer #3	Store #1	Sample #1	➔	➔	➔
Information technology flow: ➔ and ➔ (designated IT platform)							
☒	☒	☒	☒	☒	☒	☒	☒
Recall potential: ➔ and ➔							
Product identity, traceability and product segregation throughout the supply chain from “farm” to “plate”; includes transport providers							

VALUE CHAIN STAGES

The initial stages of the value/supply chain include research and development, commercial seed supply, fertilizer supply, plant nutrition, disease control, quarantine and crop protection, irrigation and water management, and agricultural mechanization.

Research and Development

In seed research and development, Pakistan lags behind its Asian neighbors by 10-30 years. To catch up, it can take steps to improve policies, the investment climate, technology, and skills over the short, medium, and long term. According to the Ayub Agricultural Research Institute (AARI) in Punjab province, 365 varieties of crops have been developed and commercially released: 67 are wheat, 19 rice, 18 maize and millet, and 18 oilseed. These varieties are described as high yielding and resistant to various diseases, but many are not in demand among growers and are not being provided to them. And according the Extension Office, Department of Agriculture, also in Punjab, R&D yields for okra, onions and potatoes are potentially higher than among progressive growers and resource poor growers (Table 4-2). These findings indicate that the national agriculture research system (NARS) is not effective in developing options and that public

extension does not communicate well with commercial growers. Because of existing seed legislation, AARI varieties are provided only to public sector agencies. Farmers must get their seed from the Punjab Seed Corporation (PSC), which has a mandate to multiply, clean, pack and market seeds to farmers. Thus, private companies do not propagate new varieties and farmers may not get to use them or high quality seed. In addition, AARI's R&D output is not linked to the market, does not bear up under rigorous biometric analysis, and is often incomplete (e.g., yield information lacks data on maturity, grain features, responsiveness to nutrients).

Table 4-2
Yield Indications for Selected Vegetable Crops and Potato (tonnes / ha.)

Crop	Potential Yield (R&D yields)	Progressive or Commercial Grower	Average Grower
Okra	30	25	8
Onions	25	10	6
Potato	47	30	18

SOURCE *Department of Agricultural Extension, Punjab Province. June 2008.*

Possible Programming

Restructure the NARS, including AARI. The NARS is under the umbrella of the National Agricultural Research Council, which has 83 research institutions, stations, and substations, yet these seem stagnant and disengaged from the private sector. Many AARI staff are nearing retirement and resources to attract talented graduates are limited. Other institutes like the National Institute for Biotechnology and Genetic Engineering and Nuclear Institute for Agriculture and Biology offer attractive remuneration and have well qualified professionals, many of whom have studied abroad. In general, the AARI is understaffed and revenue it generates reverts to the Central Board of Revenue.

Encourage Establishment of a Foundation Seed Cell. AARI requested assistance to establish a Foundation Seed Cell to support research and collaborate with the private sector, even though it doesn't have a mandate to work with the private sector. But AARI has a seed storage facility with staff not resourced, indicating little sustainability in its work. A challenge seems to be to allow AARI and other agricultural research institutes to earn income and allocate resources to ensure competitiveness as public agencies in the NARS and collaborate with the private sector on market-driven research. Donor coordination will be required as the FAO, for example, is tentatively embarking on a national seed industry strengthening and development program commissioned by MINFAL.

Commercial Seed Supply

The seed industry is dominated by large multinationals—ICI, Pioneer, Monsanto, and Syngenta—that formed the Seed Company Association (SCAP) of Pakistan, representing the better managed industry participants, all of them subsidiaries of life science multinationals. These firms tap into their own R&D, seed production, marketing, quality assurance functions, and have worldwide networks for information sharing and exchange of IP. They also know the country well and work

closely with all sectors of Pakistan agriculture. Yet they do not make strategic decisions on domestic capital investment and need help in strengthening the enabling environment. Other actors include upwards of 600 family-owned enterprises of various sizes and levels of integration. With SCAP they form a big private industry group.

The seed industry is regulated by the Seed Act of 1976 (XXIX of 1976), which gives the public sector control of seed imports, plant quarantine, genetically modified varieties, IP, variety release, seed production, and seed certification. Legislation affecting the sector has not advanced, thus the industry considers the government unsupportive. Domestic seed production, then, can be strengthened by assisting with the enabling environment (Table 4-3). For example, the private sector wants an amendment to the Seed Act to strengthen the sector, and they plan to have wider representation to provide business advisory services, links to foreign investors, and human resources development. They also would like to help build the capacity of the Bio-Safety Committee of the Ministry of Environment and ensure industry representation. If the act is amended, the private sector expects to introduce hybrid seed production and build seed grower capacity to link private seed companies to strengthen domestic seed supply and then seed exports.

Possible Programming

- Assist with policy and legal and regulatory reform to support development of a strong private sector seed industry program in Pakistan.
- Build on the private sector's capacity in the domestic seed industry, and capacity building in the government.
- A program of US$30 million to US$50 million is warranted, with about 10 percent going to R&D.

Fertilizer and Plant Nutrition

Though the fertilizer industry is considered deregulated, the government subsidizes the natural gas used in urea production, the most common high volume fertilizer, and the implication is that producers pass on this subsidy to clients. Domestic supply is about 4.8 million tonnes of urea and country consumption is about 5.6 million tonnes,[28] with the gap filled by exports. Urea is priced at US$180 per tonne and the cost to import is 8 percent higher. Absent the subsidy, it might be cheaper to import urea than to produce it locally. (The dwindling domestic supply of natural gas is also a concern.) Industry leaders, such as Engro Chemicals Pakistan Ltd, say the overwhelming concern is lack of a sound policy. A reputable supplier, Engro works closely with seed companies, sugar mills, cotton ginners, and tobacco producers, but has started to diversify away from the fertilizer sector, possibly because of the limited growth in the industry and lack of clear policy.

[28] *Dawn*, September 7, 2008; figures not verified.

Table 4-3
Enabling Environment Obstacles set by the Seed Act of 1976

Area	Obstacle	Private Sector Assistance Request
Seed imports	Restricted imports	Increase import of hybrid and non-hybrid seeds from India yet there are non-tariff barriers on hybrid rice, maize, cotton, sunflower, and vegetable seed.
Plant quarantine	Department that controls quarantine is managed by a non technical officers, that don't have the authority to inspect.	Increase coverage, and provide inspection authority to all entry and exit points of Pakistan.
Genetically modified varieties(GMVs), also called genetically modified organisms (GMOs)	Banned in Pakistan—although not mentioned in the Seed Act. Yet a national 'bio-safety committee' has been established by the Ministry of Environment, composed of members from the civil society but with no private sector representation.	Enable adoption of GMVs. They result in dramatic increases in crop production.
Intellectual property	Absence of IP protection	Protection with positive rule of law enacted in time, to facilitate investment
Expansion of varieties & variety release	All seed companies enter a two years evaluation cycle to introduce new seeds; NARS conducts the evaluations without rigor or capacity; & many introduced varieties are already commercialized outside Pakistan including in the same AEZ in India.	Allow the private sector to conduct own internal variety evaluations & success is dictated by market forces.
Seed certification.	While the FSC&RD is largely ineffective, seed certification is mandatory for some crops. The more efficient seed producers and marketers maintain a much higher standard than the FSC&RD requires. Pakistan is not a signatory to UPOV and FSC&RD doesn't have any ISTA accredited seed laboratories.	Self certification is recommended, using the public sector in a voluntary basis. Industry moves to accreditation and facilitated by GoP.
Investment incentives.		Pakistan's Board of Investment (BOI) is to focus on agribusiness including encouraging joint ventures, foreign investment in the seed industry.

Possible Programming

- Help conduct an agriculture sector assessment, including a supply chain map that considers marketing to Afghanistan, India, and Iran. Develop benchmarks to define programming actions.
- Facilitate private sector extension services including capacity training of agronomists to make fertilizer recommendations based on soil analysis and crops. Increase capacity training on the benefits of nitrogen (N), phosphorus (P2O5), potassium (K2O) and trace (minor) elements. This can be supported by technology assists including geographic information systems (GIS) and PDAs.
- Work with the industry to encourage productivity (Engro, Fauji, and new entrants). This can include developing options for rural blending plants that include major and trace elements based on soil analysis for crop recommendations.

- Help link banking and finance service providers with commercial growers and agricultural input suppliers.

Disease Control, Crop Protection, and Plant Quarantine

Plant protection and quarantine issues are regulated and managed by MINFAL's Department of Plant Protection in Karachi. The Department's financial status is not sound; it earns about US$0.75 million for pesticide product registration and plant quarantine work, including documentation for seed and plant imports and exports. These funds are transferred to the CBR.

The government is to regulate plant protection or quarantine through legislation and policies enforced by provincial governments. Enforcement is impeded, however, by inadequate quarantine facilities at border entry points; by a lack of IT at quarantine stations; and by agents being authorized to inspect only upon the request of Customs. No entry points, including for rail, air, ocean, and foot, have formal enquiry or inspection processes and generally there is no post-entry quarantine. The situation is similar when exiting Pakistan. It seems that no agricultural products are inspected, apart from cursory inspections of documents to satisfy an importing country's requirements. This leaves Pakistan vulnerable on many fronts. Wheat rust infections (Ug99) from Afghanistan and Iran have reached Pakistan, and cotton crops are threatened by the cotton leaf curl virus, which may have been imported on seed, and the cotton mealy bug and Bt cotton in short staple varieties.

Possible Programming

Given these weaknesses, industry representatives would like USAID assistance in

- ***Revising the Agriculture Pesticide Act.*** The government is preparing a new act to replace the one passed in 1971. The existing law differentiates among herbicide, insecticide, fungicide, bactericide, seed treatment product, fumigant, or whether containers should be drums, or bottles. Many pesticides sold in Pakistan are banned elsewhere. The revised draft considers micronutrients to be fertilizers, which is not done in most of the world.
- ***Building capacity for product registration***. The Plant Protection Department lacks the capacity and equipment to carry out modern pesticide registration. Plant protection products are registered on the basis of active ingredients and products go through protracted and inefficient two-year bio-efficacy trials.
- ***Improving Plant Protection Department management***. Other challenges include ensuring cost recovery and balancing stakeholder interests.
- ***Improving plant quarantine and animal health inspection services***. This could involve creating an animal and plant health inspection service.
- ***General training***. Staff need training in equipment, product registration, packing and labeling, removal of harmful products, and Hazard Analysis and Critical Control Point (HACCP) functions.
- ***Promoting farmer field schools***, which will concentrate on commercial extension services and safe use of pesticides.

Interventions will require a long-term commitment, which would make them high profile.

Irrigation and Water Management

For agriculture water management, please see Chapter 3.

Agricultural Mechanization

Agricultural practices developed in the 1960s and 1970s are still popular in Pakistan. Seeds are planted by hand, crops are harvested by hand, maize is shelled by hand, and stationary wheat and rice threshers are fed manually. Only irrigated wheat and some rice crops are harvested by machine. Most commodities are hauled in sacks and transported on single-axle trailers. Efficiency, performance, occupational health and safety are rarely considered and women are engaged mostly in menial labor. Under such conditions, obtaining optimal yields is nearly impossible. Rural infrastructure impedes the introduction of agricultural mechanization and bulk handling and storage, and rural social structure hinders the development of finance options. In addition, many planners and managers in MINFAL, provincial departments, NGOs, and donor agencies are not aware of alternative technologies, and even those who are aware are in no position to make changes.

Possible Programming

- Explore mechanization options for harvesting, crop delivery, and processing, especially for pre-cleaning, pre-sorting, cooling, drying, and storage, and for applying IT and quality assurance across the supply chain consistent with the low cost of labor and the need to generate more employment.
- Create opportunities for collaboration between international manufacturers and Pakistani entrepreneurs.
- Demonstrate to Pakistani growers the most appropriate agricultural equipment and supporting technologies consistent with the low cost of labor and the need to generate more employment.[29]
- Foster best practices in occupational hazard and safety measures.
- Provide training in repair and maintenance as important to agricultural development.
- Support a national agricultural machinery association and facilitate links to international organizations.

[29] We do not recommend subsidizing or promoting the premature mechanization of agriculture with capital-intensive technology that would increase unemployment. Let the market determine the pace of mechanization.

WHEAT

The wheat supply chain is similar to the rice supply chain shown in Figure 4-1, except that it extends to domestic and informal export markets.

Factors Affecting MINFAL's Wheat Cost Estimates

1. Land preparation is under valued.
2. Low seed and sowing costs reflect poor quality.
3. Fertilizer costs may result from using inappropriate fertilizer types and quantities.
4. Irrigation costs reflect undervaluing of water resource.
5. Harvesting costs reflect inefficiencies and cheap labor rather than the efficiencies of partial mechanization.
6. Land rental costs assume growers are sharecroppers, reflecting the landlord / tenant situation; absentee landlord; combinations of this situation, which ultimately is reflected in lower agricultural performance.
7. Yield estimates are stagnant from 2007-08 to 2008-09.

Production

Pakistan's wheat production has increased for the past 16 years. Area planted is about 8.6 million ha., 85 percent of which is irrigated and 97 percent in high yielding varieties. Research yields for irrigated bread wheat production are around 6,130 kg / ha.—low compared to international best practice (e.g., Australian growers using irrigation in a similar production environment regularly obtain yields of 8,000 kg / ha.). Progressive growers achieve around 5,500 kg/ha., and irrigated yields of 2,916 kg/ha. The national average for the past five years has been 2,770 kg/ha. Barani yields reach 1,530 kg/ha. (about half the irrigated yields). Total production is about 23.3 million tonnes, of which 98 percent is from high yielding varieties. Given area planted this is a straight line relationship of area planted and production. About 85 percent of production occurs in Punjab (75%) and Sindh (11%). Private millers estimate that per capita wheat consumption is about 136.0 kg / person per annum, and future demand can be estimated using predicted population growth and surplus export trade possibilities.

Possible Programming

- Fast track support for PBR to allow access to the latest genetics. Enforcing PBR should enhance competitiveness and encourage wheat R&D to push the yield barrier.
- Identify options to increase irrigated wheat production to reach the progressive grower yields.
- Diversify from bread wheat to durum and other types such as for grazing, fodder.
- Conduct R&D on triticale, rye, and other cereals more suited to barani and Rabi (winter) season agriculture while fast tracking R&D on other cereal crops (e.g. maize, sorghum, millet) to develop options for human, livestock, and industry use.
- Move barani wheat to other crops more suited to dry land /rainfed agriculture (e.g. modern winter pasture varieties).
- Pakistan's average yields are low compared to China (Table 4-4). If the 7.3 million ha. of irrigated wheat achieved progressive grower yields of 5.5 tonnes/ha., Pakistan would achieve 40.0 million tonnes of production–decreasing the likelihood of a wheat crisis.

Table 4-4

Wheat Yields and Trends for Pakistan and a Range of Other Countries (tonnes / hectare)

Country	2001	2002	2003	2004	2005	2006	2007	Trend
China	3.81	3.78	3.93	4.25	4.28	4.49	4.78	
India	2.71	2.76	2.61	2.71	2.60	2.62	2.67	
Pakistan	2.33	2.26	2.39	2.37	2.59	2.52	2.77	Flat
Thailand	0.80	0.80	0.80	0.80	0.80	1.00	1.00	
USA	2.70	2.36	2.97	2.90	2.82	2.60	2.60	

Sources of data MINFAL, Pakistan, August 2008; all other countries FAO STATS.

Costs. Wheat growers' costs of production vary greatly. MINFAL's estimates of the average cost of production in Punjab Province for 2007-2008 and 2008-2009 crops are summarized in Table 4-5. The table shows escalating production costs of some with higher increases for seed cost, fertilizer and fuel. Industry figures reflect a progressive farmer gross margin, indicating a gross margin of around US$230/ha. (see table in appendix). General industry benchmarks, however, suggest that these data be treated with caution.

Table 4-5

Wheat Cost of Production Indications for Key Budget Categories (Provisional)

Operation / Input	Cost / ha.						
	2007-2008 Crop			2008-2009 Crop			
	PKR	US$		PKR	US$		%
		FOREX	Total US$		FOREX	Total US$	
Land preparation	2,999	76	39	3,982	76	52	8
Seed and sowing	3,722	76	49	5,229	76	69	11
Bund making	183	76	2	247	76	3	1
Herbicides	778	76	10	827	76	11	2
Irrigation	4,058	76	53	4,409	76	58	9
Labor - irrigation, water course cleaning	506	76	7	766	76	10	2
Farm yard manure	222	76	3	296	76	4	1
Fertilizer	6,054	76	80	12,330	76	162	26
Harvesting	3,149	76	41	4,718	76	62	10
Threshing	2,927	76	39	4,409	76	58	9
Land rental	7,684	76	101	11,093	76	146	23
Total cost	25,688	76	338	48,306	76	636	100

Values in Pakistan Rupees (PKR) are rounded

SOURCE MINFAL, Agriculture Policy Institute, September 2008.

Support Pricing. The government introduced a wheat support price in August 2001. Although there are deviations from the original intent for political considerations, MINFAL's Agriculture Policy Institute provides annual updates on wheat supply and demand and sets a support price. Prices are set just before commercial growers make a Rabi crop planting decision, and MINFAL

states that support prices should be set early to avert a steep decline in wheat area planted. In 2008 there were several adjustments. Prices were set at PKR510.00/40 kg (one maund) on February 29, then revised to PKR625.00/40 kg on March 31 (one third of Sindh Provinces' wheat crop had been harvested). This resulted in a volatile market, and there has been a constant FOREX slide of the Pakistan Rupee to the US dollar over this interval to date. Wheat prices in domestic and international markets are summarized in Table 4-6. To recognize the political dimension of ensuring wheat availability, we recommend extending any wheat subsidy to those living below the poverty line, such as those receiving food stamps, mostly in urban areas.

Table 4-6

Wheat Support Price Indications (draft; provisional)

Wheat Crop Year	PKR/ maund (40 kg)	PKR/ kg	PKR/ tonne	US$/ tonne. PRK76.00 = US$1.00	US$/tonne - import parity	Wheat Prices, Predicted (futures), Chicago Board of Trade	
						US$ / tonne	US$ / tonne. FOB
2007 / 2008							
Feb-29	510.00	12.75	12,750	168	185		
Mar-31	625.00	15.63	15,625	206	226		
2008 / 2009							
Sep / Oct. planting. MINFAL proposal, Sep 7, 2008	1,000.00	25.00	25,000	329	362	Dec-08	285
						Mar-09	294
Wheat, CIF Karachi, September 2008	1,200.00	30.00	30,000		395		
	1,400.00	35.00	35,000		461		

Notes:

FOB free on board.

Information source: visited September 7, 2008 http://www.awb.com.au/NR/rdonlyres/42F71DD3-E8F6-4844-8269-2DA8A8879AF4/0/080905QLD.pdf

Import parity, allowing for around 10 percent on top of domestic prices (estimated situation).

Import parity actual indications based on September 7, 2008 CIF prices of PKR1,200 to PKR1,400 / maund. This is around 16.0 % to 30.0% on top of domestic prices (current estimates). Reasons for this very high import parity at the top end' may include (assumptions) lack of bulk handling resulting in low efficiency of port operations for wheat off loading from ships and in domestic distribution, and price manipulation.

MINFAL's estimated wheat support price for 2008/2009 seems high at US$36/tonne more than required. There is clearly a need for stakeholders to work together and agree on industry strategic directions, and ensure a workable regulatory framework.

Trade and Production

Wheat commodity traders, flour millers, bakers and wheat trade and flour milling industry associations in Punjab and Sindh Provinces have special insight into wheat production and trade.

Commodity Trade, Imports, and Exports

Under a MINFAL directive, Provincial Food Departments control wheat markets. They set quotas based on milling capacity, impose bans on inter-district movements, and license flour mills—which are known for high and irregular transaction costs that involve rent seeking. A parastatal, the Trading Corporation of Pakistan (TCP), imports wheat in the event of shortages. Meanwhile, the export market has great potential, as evidenced by the high volume of informal exports with Afghanistan, Iran, India, and some central Asian states.

The private sector, which has strong interest in wheat trade and in storage facilities to support flour mills and marketing surpluses, wants the federal and provincial governments to end restrictions on storage and free market pricing (i.e., deregulate the market). Complete deregulation, however, may be premature as the current grain handling and storage infrastructure is inadequate. One recommendation is to establish a national wheat board that operates at provincial and federal levels, like those in other Asian and Pacific countries (e.g., the Australian Wheat Board). Such a board in Pakistan could be a professionally managed public–private partnership involved in procurement, storage and logistics, or be managed by stakeholders, with members including all concerned in the wheat trade and with shares publicly traded.

Government Interference in the Wheat Market

The Punjab Provincial Food Department forced commercial growers to sell their crop at half the market rate, antagonizing seed companies, commercial growers, the wheat commodity trade and the wheat flour industry. The lack of quality seed may impact commercial Rabi 2008 wheat crop growers. The Sindh Provincial Food Department appears to be a rent-seeking activity of the Food Minister, who uses the militia for enforcement. The Provincial Food Departments restrict inter-district wheat movement and then only allow millers to procure if they hold special, high-priced permits.

The need for bulk handling of the wheat crop linking farms, silos, road, rail, silos, with known weights and quality assurance across the supply chain is urgent. One entrepreneur in Karachi is investing in a port facility for bulk unloading and loading of oceangoing vessels, and road transport for bulk carriage. Supporting such entrepreneurs could be beneficial.

Public sector competition can be introduced to assist startups. For example, Corn Products International, Illinois, USA, and its subsidiary in Faisalabad, Rafhan Maize, are discussing purchase by Bunge, a multinational specializing in grain handling, feed mills, and other activities. As of September 2008 Bunge was considering entering Pakistan in early 2009 and getting involved in the domestic grain market. Investments by Bunge or other agribusiness multinationals in international commodity grain trade present the government with opportunities to review the roles of PASSCO, the Provincial Food Departments, and TCP.

Public Sector Procurement

The Pakistan Agricultural Storage and Supplies Corporation (PASSCO) is a parastatal controlled by a nine-member Board of Directors appointed by shareholders and chaired by the Secretary of MINFAL. PASSCO was established to procure wheat as diet staple and other agricultural commodities; provide a grower support price for wheat and other commodities; transfer wheat to deficient provinces and regions; and to stabilize agricultural commodity prices by intervening in

the open market and maintaining strategic reserves to meet any supply emergency. PASSCO also procures for the armed forces, with each province paying for their wheat.

MINFAL establishes commodity procurement targets, and PASSCO allocates these quantities into operational and strategic reserves for provinces. PASSCO stores wheat in RCC godowns, mechanized silos, and open storage areas covered by tarpaulins. Wheat sold to millers in low production provinces is priced on the basis of the commodity, logistics, and other costs; current year's incidental charges are PKR3,365.00/tonne (around US$44.00/tonne). Storage costs are high compared to costs in the private sector for a number of reasons: use of only new gunny bags though less expensive used bags in good condition are available; lack of grain quality checks at procurement centers; common weight shortages; lack of pest control; and lack of overhead cost tracking. In addition, PASSCO has no ISO, HACCP, or other such certifications. While the head office is supposedly networked, no zonal offices or procurement centers are networked to each other or linked to the head office.

The private sector could easily manage the basic trading and logistics role now carried out by PASSCO and the Food Departments, though it would be operating in a deregulated market while benefiting from assistance with infrastructure and training. A regulatory framework that covers acting on behalf of any government agency would encourage the private sector to invest in the wheat (or other commodity) business, supported by accreditation and benchmarked to international best practice.

Dawn Bread, A. Rahim Foods (Pvt) Ltd, Lahore

Established in 1984 in Karachi, Dawn has six units, a distribution network covering most of the country, 40 percent market share, and 3,000 employees, a sizeable percentage of them women in responsible positions. The company operates three shifts per day, 24 hours per day, making bread, cakes, cookies, frozen goods, and special items for fast food chains. It exports frozen products to a range of countries, including the United States, and is unable to meet demand. Exports, though low in volume, are valued in U.S. dollars so this income stream contributes double the domestic market. This indicates the likely direction of Pakistan's industry with a continually depreciating currency, further supporting the case for a deregulated and private sector driven wheat market.

Possible Programming

- Review the 1973 mandate in relation to the country's needs (i.e., should PASSCO still have a role in grain procurement and management?)
- Conduct an independent technical, financial, and management analysis of costs, income and other aspects of grain commodity trade in relation to PASSCO and commercialization and privatization. Charges levied by PASSCO and payment procedures by clients are not transparent, PASSCO does not seem to consider options for private sector collaboration, and the value of PASSCO's assets is unknown. Can a private sector operator lease and manage a PASSCO facility? How is PASSCO's infrastructure supported—by the government, bank loans, donor, or combination of sources?
- Consider helping to transform PASSCO into a publicly traded company listed on the stock exchange, allowing professional management or a foreign joint venture to manage the revised corporate structure outcome; or sell the organization in parcels. Several

options exist to provide agribusiness loans based on transparent prefeasibility and feasibility studies for leveraged buyouts, or other options to transform PASSCO.

Postharvest Infrastructure and Milling

Flour millers' infrastructure and wheat storage capacity are dictated by quota allocations. Millers, for example, can store wheat for up to only 30 days even if their have more capacity. This allocation arises from the Food Departments' wheat crop and stocks. The government recently fixed wheat miller quotas on the basis of population of an area or town/city, with no relation to market forces for domestic or export prospects for commodity trade, traditional outlets, or value-added wheat exports. Before 1992, one USAID project assisted the Food Department with wheat handling equipment, storage and transportation facilities. Now, there is need for a role reversal, and the earlier collaboration presumably gives USAID considerable negotiation possibilities.

Infrastructure and Storage Capacity

According to MINFAL the government can store about 10.0 million tonnes of wheat, or 45 percent of the country's total requirement at peak harvest based on current production. Millers in Punjab Province can store 1.3 million tonnes and millers nationally can store about 3.0 million tonnes. Therefore the private sector can store 13 percent of the national wheat crop. Private sector capacity to store wheat needs to be increased to ensure adequate wheat stocks, or the private sector should be allowed to diversify as desired (e.g., develop multipurpose facilities), including to produce flour of other crops (e.g. of pulses), thereby making the Provincial Food Departments and PASSCO redundant.

Possible Programming

Consider providing support to increase private sector managed wheat storage and handling capacity to about 20.0 million tonnes. The volumes need to be assessed based on leakage, consumption rates, and national population growth, as well as grain production increments that give a regular exportable surplus. Funding can be via existing banking arrangements of entrepreneurs with USAID's technical support. This is an accepted method for making the public sector redundant while ensuring national regulatory and industry structures are in place. Once government storage is no longer used, it could be leased to the private sector for other crops, converted to more valued-added items, or sold.

Value Adding

The recovery rate for wheat flour milling is 67 percent. Flour is used to make nan, chapatti, and other products. The remaining 20 percent is fine flour and 13 percent is bran. Recovery can be (as with rice, maize) adjusted in milling, which is to the miller's advantage in terms of product range and profit. A range of entrepreneurs are adding value to wheat. Some were operating before Partition, some have been in business more than 25 years, and others are recent entrants. They run flour mills and plants that manufacture wheat flour products, such as bread, pasta, spaghetti, noodles, buns, cookies, and frozen pastry. Since Pakistan doesn't grow durum wheat, millers producing pasta products use bread wheat grain—showing again the need for market-driven R&D and collaboration with industry stakeholders across the value chain.

Quality Assurance and Product Traceability

Food Departments license flour mills (and perhaps other enterprises), but licensing does not seem to confer any value and enables rent seeking. Though many businesses say they are ISO and

HACCP accredited, most of those the study team visited had expired certifications and did not mention renewal of accreditation. Public sector organizations did not have certifications and often did not seem aware of their existence, much less the necessity and value of having them. No public or private sector organization demonstrated product traceability. Quality assurance and product traceability, facilitated by IT across the supply chain, would strengthen and coordinate the supply chain for just in time delivery inventory management. Even among well established individual agribusinesses, however, there is little appreciation for the worth of forming supply chains that create value.

Conclusions

Pakistan could benefit from farsighted interventions that build its domestic wheat supply chain. Interventions, however, should be based on a framework agreed to by the federal and provincial governments, ministers, ministries, and departments, and on detailed analysis that reveal where progress can be achieved in the supply chain. Ideally, one could have stop-go clauses in the event of abuse by public sector stakeholders, but this should be negotiated in a framework MOU between governments. It may be especially challenging to work with the private sector and NGOs without involving the public sector, where the bulk of challenges reside. In sum, what is needed is more than a "wheat" policy: a modern, comprehensive national agriculture policy that favors the private sector and arises from genuine involvement of stakeholders.

RICE

Pakistanis consider rice a luxury food grain and the export market is well established.

Production

About 2.6 million ha. of irrigated land are planted in rice, 60 percent in basmati and 30 percent in coarse rice. Punjab and Sindh account for 70 percent of national production and Balochistan Province 10 percent. Basmati is produced in Punjab. Research yields from AARI are high. Basmati types yield less than coarse types (from 4,940–6,620–7,115 kg/ha.). Coarse yields reach 10,870 kg/ha. Progressive Basmati growers can regularly obtain 3,450 kg/ha. For the past five years, the national average yield has been 3,200 kg/ha.

Pakistan's rice production generally shows a 16-year increase,[30] totaling 5.5 million tonnes from 3.2 million tonnes. Area and production volume decreased slightly in the last year, displaced by sugar cane and high diesel prices that discouraged growers from planting more area. About 60 percent of annual production is exported. Basmati varieties provide a high quality export that positions Pakistan favorably over volume exporters like Vietnam. A key competitor is Thailand, whose "hom malis" – a fragrant rice variety--has high export acceptance.

[30] Data is for 2006/2007 except where noted

Exports and Quality Assurance

The government also regulates the rice market. Exporters register with the Rice Exporters Association of Pakistan (REAP), which issues a quality certificate for all export requests that pass the quality test. The rigor of the test and the international validity of the certificate have not been verified, nor is it certain that all exporters are members of REAP. Many internationally accredited inspecting firms exist (e.g. SGS, OMIC), and the buyer and/or the seller should choose the inspection agent by mutual agreement; membership in any industry association should be based on mutual benefit. REAP levies a 0.25 percent export development surcharge on invoice sale value, although this is often manipulated. Funds go to the CBR account, and there is no indication these funds benefit the industry (e.g., R&D, promotions). Though REAP is a private association, it could become a venue for rent seeking activity; it should be assessed objectively in relation to international best practice.

Possible Programming

- Take steps to dramatically increase R&D and commercial yields for basmati and coarse rice (see Table 4-7, which compares Pakistan to other producers). Most production in Pakistan is irrigated, but national yields are low.
- Fast track the introduction of hybrid basmati and coarse types to increase production volume and commercial opportunities. Some non-basmati varieties give the higher yields of coarse rice yet retain basmati quality. NARS is not exploring such options even though irrigated water supply is running out.
- Evaluate the worth of moving basmati to other production areas, including cool tolerant basmati types suited to areas of NWFP and AJK, or heat tolerant types suited to Sindh Province.
- Promote less water-dependent agricultural activities—sorghum, millet, permanent pastures and livestock—where rice is inherently unsuitable.

Guard Agricultural Research and Services Private Ltd.

Guard exports rice to 38 countries, develops rice varieties, and engages in product research and seed and crop production and processing. Working with a Chinese seed company since 1999, Guard Rice is Pakistan's top developer, producer, and marketer of hybrid rice. It works closely with growers, providing hybrid rice seed, extension services and buy back arrangements. Its hybrid rice now covers 5 percent of Pakistan's rice area. This achievement is remarkable as NARS has yet to develop hybrid rice. Guard plans to introduce new technology to growers: planters, combine harvesters, grain dryers, bulk handling and storage. Guard provides a model for working on crops in a supply chain setting. Guard is the supply chain driver as a miller with designated asset specificity and is a fully integrated agribusiness with interventions across the supply and value chain (R&D, seed production and supply; commercial contract with extension services and procurement; postharvest milling, procurement, quality assurance with product traceability and marketing to domestic and international destinations).

Table 4-7
Rice Yields and Trends for Pakistan and a Range of Other Countries (tonnes / hectare)

Country	2001	2002	2003	2004	2005	2006	2007	Trend
China	6.15	6.19	6.06	6.31	6.25	6.25	6.34	
India	3.12	2.62	3.12	2.98	3.15	3.19	3.21	
Pakistan	2.75	3.02	2.96	2.99	3.17	3.16	3.19	Upward
Thailand	2.62	2.61	2.65	2.86	2.96	2.91	2.69	
USA	7.28	7.37	7.48	7.83	7.44	7.70	8.05	

Notes The data is not separated for Basmati or coarse rice.
Sources MINFAL, Pakistan, August 2008; all other countries FAO STATS.

MAIZE

Pakistan's maize industry faces significant challenges: weak extension services, enormous postharvest losses, inadequate infrastructure, and a lack of private sector quality controls. The globally rising demand for maize as a raw material for feed milling or animal feed as a finished product offers Pakistan a very real export opportunity for regional markets and in the Middle East. Development of the agriculture sector in general and the maize industry in particular is going to require major reforms in the purchasing regime and deployment of best practices at all points along the value chain. Demand for locally produced maize is expected to increase, due in part to feed mills supplying the poultry and other livestock industries.

Production Trends

Since the 1990/91 growing season, the area planted in maize has increased by about 200,000 ha. and production has doubled to 3.1 million tonnes. Production continues to enjoy respectable growth, averaging annual yield increases of approximately 8 percent from 2001-2008. For the 2007/08 growing season, Pakistan produced approximately 3.3 million tonnes, of which 25 percent was planted in hybrid maize. For the 2006/07 season 1,020,000 ha. were under maize. This is half the total area under rice and an eighth of the area producing wheat. SCAP predicts that hybrid seeds will account for 50 percent of production by 2012 to meet production goals of 5.0 million tones. Table 4-8 compares the area under maize and domestic hybrid deed supply in mid-2008.

Most of Pakistan's commercial maize is irrigated, but the industry's production is inferior to other Asian competitors such as Thailand, whose consistent R&D yields are over 13 MT/ha. Pakistan's national average yield for the last five years is 3,037 kg/ha.; yields have doubled since the 1990/91 season mainly because of the higher yielding hybrid seed. The highest yields are in Punjab, which produces 4,390 kg/ha., compared to NWFP, which produces 1,235 kg/ha. (using non-hybrid seed). Table 4-9 compares Pakistan's maize production to that of regional and international competitors.

Table 4-8

Maize Area and Domestic Hybrid Seed Supply Status, mid- 2008

Description / category	Spring (Ha)	Summer (Ha)	Total
Total planted hybrid corn area	178,138	151,822	329,960
Total white hybrid corn area	6,073	25,911	40,911
Total Area	184,211	177,733	370,871
Yellow hybrid corn area, percent	97%	85%	89%
White hybrid corn area, percent	3%	15%	11%

Note Some figures rounded up or down. Area – based from acres.

SOURCE SCAP, August 2008

Table 4-9

Maize Yields, with Trends for Pakistan and Selected Other Countries (tonnes / hectare)

Country	2001	2002	2003	2004	2005	2006	2007	Trends
China	4.70	4.93	4.81	5.12	5.29	5.38	5.41	
India	2.00	1.68	2.04	1.91	1.94	1.91	2.16	
Pakistan	1.77	1.86	2.00	2.85	2.98	2.91	3.24	Upward
Thailand	3.73	3.73	3.85	3.87	3.83	4.16	3.84	
United States	8.67	8.12	8.93	10.06	9.29	9.36	9.48	
Viet Nam	2.96	3.08	3.44	3.46	3.57	3.70	3.75	

SOURCES MINFAL, Pakistan, August 2008; all other countries FAO STATS.

Challenges

Pakistan's domestic maize industry faces major challenges to its competitiveness: ill-equipped, poorly trained extension service providers who don't reach smaller growers; enormous postharvest losses; poor infrastructure; and lax quality control. Providers of crop inputs require significant strengthening to ensure they provide objective extension messages to commercial growers while selling good quality and truthfully labeled inputs.

A problem common to all agriculture sectors, as well as the maize segment, is that rural traders and buying agents either have money but no technical knowledge, or knowledge but no money. Even multinational subsidiaries like the Seed Company Associations of Pakistan and Rafhan find it difficult to reform traditional agricultural practices given this situation. Inadequate training, outdated tools, and obsolete infrastructure result in a 25 to 30 percent loss of a seasonal harvest along the length of the supply chain between farmgate and the end consumer—for small and large farmers alike.

Improper grain handling is worsened by the lack of modern technologies and training. Crop drying or storage facilities in rural Pakistan are rare. The local authorities, on land owned by the provincial government, often license markets that are in very poor condition and not designed for volume trade (e.g. a 40-foot trailer would be unable to enter a local market). The private sector is not involved in quality assurance, meaning processors take what they can get; for example, all grains are usually unloaded onto the ground and exposed to heat, rain, and dirt.

Opportunities

Pakistan's maize industry has significant opportunity for growth in feed milling. The local feed milling industry produces about 5 million tonnes of poultry feed annually and is growing at about 10 percent per year. That growth rate is expected to rise to as high as 15 percent. Maize constitutes 60 percent of the feed. Punjab province has more than 80 percent of the country's poultry farms, and there are concentrations of farms in the Mansehra District of NWFP. The proximity of maize crops to farms presents a value and logistical advantage. And with Afghanistan's egg volume imports growing at 20 percent per year, the NWFP is well placed to develop higher quality feed to meet the demand for Pakistani poultry. To meet demand from modern poultry farms the quality of maize feed needs to improve. Maize destined for feed mills must be certified pesticide-free by the time it enters the human food chain.

Conclusions

Demand for maize, largely from the poultry and livestock subsectors, is expected to increase, and more can be done to add value to Pakistan's maize crop. Maize could very well become more important than sugarcane and other high profile crops because of its productive capacities and varied uses—but only if industry stakeholders invest heavily in transport, handling, drying and storage infrastructure. Extension service providers need to learn modern techniques and to promote the use of hybrid seeds. Markets must be re-thought to handle large volumes, reduce crop loss, and promote quality control.

Rafhan Maize Products Co., Ltd., Faisalabad

Rafhan procures 16 percent of national production, about 30 percent directly from farmers. The company would prefer to purchase from growers through contracts but this requires an efficient and experienced extension force as well as infrastructure. Absent strict quality standards Rafhan must "take what it can get" from local markets, meaning the crop is often uneven, exposed for extended periods, improperly dried and stored, and partially lost between the farmgate and company facilities. Rafhan is attempting to export value-added starch, glucose and sweeteners. It has invested in a factory in Punjab and upgraded a plant in Sindh to support domestic markets and export markets in the Near East.

To meet goals for contract farming, value addition, and exports, Rafhan and the maize industry must invest in infrastructure and workforce. District storage and drying facilities will improve quality; training private extension providers will ensure equitable pricing; and strict procurement standards enforced by processors will improve the grower situation.

OILSEEDS

The condition of the oilseed industry is indicative of the agriculture sector as a whole: the private sector is ready to stride into the future, add value, and upgrade techniques—but needs an enabling environment.

Pakistan consumes 3 million tonnes of edible oil, 67 percent of it imported. Per capita consumption of 20 liters per year will likely rise with population growth and possibilities for adding value. Most consumers use Banaspati Ghee, a mixed oil that claims 70 percent of the edible oil market. Health conscious consumers, however, are switching to soft or polyunsaturated oils such as canola, olive, soybean, and sunflower.

Imports of crude oil are rising as Pakistan now has more refineries clustered near ports. Crushing and refining capacity, however, are needed in upper Sindh, Punjab, and NWFP, where domestic oilseeds are produced. The cheapest and most readily available local oil is cotton seed oil. It is available as a generic product and can contain gossypol and probably pesticides.

Dalda Foods Ltd, Karachi

Dalda products claim 27 percent of the high end of the domestic edible oil market, or 5 percent of the national edible oil market. Dalda has a well equipped and professionally staffed laboratory, and ISO and HACCP certifications. Dalda wants to work with local industry to improve the supply chain. More domestic procurement would reduce their foreign exchange burden and mitigate the effects of import lead and lag times, which can reach 60 to 90 days. To promote domestic market crop production, crushing and refining, USAID should focus on agribusinesses that build a domestic capacity across the supply chain.

Cotton seed oil consumption is 0.5 million tonnes. Oil from canola is produced from seeds imported from Europe and Australia with local crushing. Canola has largely replaced soybean, which used to be sourced from Brazil and the United States.

Unilever Pakistan Ltd and Value Addition in Edible Oil

Headquartered in Karachi, Unilever procures crude oil from Rafhan Maize, then refines, deodorizes, packages and sells about 5,000 tons of maize oil through a well-established distribution network. Value addition is impeded by the excessive authority of Provincial Food Departments, whose ill trained staff analyze food samples using irregular procedures and antiquated equipment. Test results are often forged or biased to favor local manufacturers. The private sector ought to establish internationally accredited laboratories to independently test and certify inputs, and challenge the government when appropriate. The government will need to facilitate and accredit this process to ensure the standards set are objective and objectively measured.

Palm oil, which accounts fro 90 percent of imported edible oil, is imported from Indonesia and Malaysia, but could be produced on plantations in lower Sindh near the Indus Delta. Olive oil is imported from Spain. Olive oil production has never received careful attention in Pakistan with all R&D confined to the public sector and PODB, although there are many AEZs suited to the crop, including large and smallholder land in rural areas. Production of this crop should be fast tracked, allowing for five years of R&D and five years for production to start. The crop could provide rural employment, including of women, and could become exportable.

Pakistan produces a range of oilseed crops, but only yields for rapeseed and sunflower can be readily compared to international yields, and the data show that yields are low. Winter oilseeds like, canola and sunflower, compete with wheat and cotton. MINFAL foresaw the ‘crop competitive’ effect as a key issue, although growers received good oilseed prices in 2008 and growers are

expected to allocate more land to oilseed crops. Yield indications for selected countries are presented in Table 4-10.

Although cottonseed oil is a key ingredient in Pakistan's low value and quality edible oil industry, in 2008 0.2 million tonnes of canola were produced, and sunflower reached 1.1 million tonnes. Soybean production is restricted by lack of PBR, but palm and olive oil both have a potential. Recent rises in the price of palm oil have renewed interest in this crop.

Estimates of domestic oil production potential seem conservative as they assume a static supply. Supply, however, can be improved by the addition of soybean and by converting area to oil palm and olives. Full scale R&D is required to identify olives suited to Pakistan's Agricultural Economic Zones (AEZ) and to areas suffering environmental stress or to less productive barani areas.

Table 4-10
Rapeseed and Sunflower – Yield Comparison of Pakistan to Selected Countries (tonnes / hectare)

Country	2001	2002	2003	2004	2005	2006	2007	Trends
RAPESEED								
China	1.60	1.48	1.58	1.81	1.79	1.81	1.47	
India	0.94	1.00	0.85	1.16	1.04	1.12	1.08	
Pakistan	0.89	0.93	1.00	1.04	0.96	0.96	0.96	Down
USA	1.54	1.34	1.59	1.81	1.59	1.53	1.40	
SUNFLOWER								
China	1.45	1.72	1.49	1.66	1.89	1.80	1.76	
India	0.58	0.53	0.46	0.55	0.62	0.56	0.60	
Pakistan	1.73	1.74	1.19	1.40	1.24	1.07	1.24	Flat
Thailand	0.87	0.76	0.70	0.77	1.08	0.67	0.73	
USA	1.50	1.27	1.36	1.34	1.73	1.36	1.62	

SOURCES of data MINFAL, Pakistan, August 2008; all other countries FAO STATS.

OTHER SUBSECTORS

The agriculture sector should be approached as a whole. Targeting selected crops can skew strategies unduly. Therefore, we recommend a full supply and value chain analysis for the sector to refine programming priorities. In this regard, some observations on the potential of other subsectors—pulses, horticulture, livestock, inland fisheries and aquaculture, and farm forestry—are warranted.

Pulses and Horticulture

Pulses, such as chickpeas, lentils, and mung beans, are a traditional part of the South Asian diet. Pakistan imports considerable quantities of pulses, yet could be much more self sufficient. The supply chain could be modernized by installing dhal milling equipment with strict occupation

heath and safety (OH&S) requirements (current equipment is old and operators often suffer severe lung disease at an early age due to the fine dust produced by dhal milling).

Opportunities for annual horticulture could be developed for domestic markets (e.g., new retail food chain entrants) and for export markets, fresh (vegetables, flowers, ornamentals) as well as processed (frozen, tinned) from a range of AEZs. In addition, some perennial crops are eminently suited to Pakistan: avocado, kiwi fruit, and nuts, possibly almonds, macadamia nuts, pecan nuts, and walnuts. Domestic and export markets hold potential for perennial horticulture, if certain challenges are met. These include longer lead times before harvest, market strategy, R&D, and support for new crops across the supply chain—including quality assurance, sorting, grading, packing, and product traceability.

Livestock

In 2007/2008 the livestock subsector contributed 52 percent to agricultural GDP and 11 percent to Pakistan's total GDP, grew 3.8 percent, and directly affects the lives of 20 percent of the population. The sector could benefit from a number of interventions, a possible first being an evaluation of imported, exported, and domestically traded products, including formal and informal trade (e.g., processed meat and dairy; beef, mutton, poultry products, including eggs exported to Afghanistan). Challenges include converting informal into formal trade, and predicting consumer trends.

Breeding Stock and Modern Genetics

There are many options for improving the livestock subsector by assisting the private sector, particularly with ruminant breeding. Most breeding stock are held by livestock farms managed by the government in each province. Most if not all of these farms are likely short of operational funds. These animals (adapted to the Pakistan AEZ) are not well maintained, or are unable to continually contribute to domestic herd improvement. Genetic diversity has been lost, such as with the well adapted 'Sahiwal-Sindhi' dual-purpose breed of cattle. This breed was developed in Pakistan, though the largest herd may now be in Australia; and Sahiwal herds are reportedly in Sri Lanka with semen supplied back to Pakistan.

Here, assistance could aim to help create private stud stock in large and small ruminants, to bring in new beef and dairy strains through artificial insemination, and to improve herd recording and performance testing. Entrepreneurs are importing poultry genetics and breeding for layers and broilers, and their activities could be strengthened. Finally, better herd management of horses, donkeys and mules would allow Pakistan to benefits from these well adapted and high performance livestock.

Fodder and Forage

A large amount of fodder seed is imported but could be produced in Pakistan (e.g., forage legumes and sorghum).The private sector could take up these activities, which present sound options for entrepreneurs to engage with innovators in other countries. Fodder production for livestock rearing is a very traditional farming pursuit that needs to be modernized, along with grazing, conservation of hay and silage, and feeding of mobile and sheltered herds.

Abattoirs for Small and Large Ruminants

Abattoirs are regulated under the Slaughter House Act of 1963. Licensed premises were built and are controlled by municipal committees to provide anti-mortem and post-mortem facilities. There are unlicensed slaughterhouses, mainly in villages and small towns. Livestock traders and butchers usually control the animal holding area near the slaughterhouse. Livestock need to be better treated in feeding, watering, veterinary management, handling, and transport. Some facilities, though well designed, were not built to modern standards. The slaughterhouses and surrounds are often unhygienic, with penned animals, slaughterhouse offal, and effluent polluting the area.

Pakistan's five modern slaughterhouses serve the domestic market and export fresh and chilled meat to the Middle East and UAE. Al-Eman, in Lahore, exports to Kuwait where it has its own outlets. Anees Brothers, also in Lahore, serves Metro Cash and Carry. KATCO, in Muredke and Gujranwala, exports to Dubai and Kuwait. Karachi Live Animals exports goat meat and cow calves on large scale. Zeinth has six, fully air conditioned retail outlets in Lahore and is a small volume, high-quality exporter. All these facilities are assumed to be HACCP certified, and are often visited by buyers who make joint inspection with the certification service providers.

Poultry Slaughtering and Processing

The poultry processing unit owned by K&N Farms, Lahore, is the only known designated and HACCP certified facility. The unit was established by ARTAL Group, Belgium, previous KFC franchise owner and operator in Pakistan. K&N uses has renowned STORK equipment, can slaughter 8,000 birds per hour for a range of products (whole chickens, processed chicken, poultry sections) and blast freezes final products.

Pakistan Poultry Association, Lahore

Most poultry farmers are not registered with the Taxation Department, so only 120 of 10,000 growers are members of the PPA. The industry has experienced incredible growth as demand for Pakistani poultry at home and in Afghanistan has grown at a rate of 20 percent per year. Pakistani producers have been implementing modern farming techniques, including environmentally controlled houses (400 in and around Lahore, with another 200 under construction). The industry should consider dispersing some houses to better climates to reduce construction and operating costs and mitigate environmental concerns, though it means higher logistical and transport costs. Geographic dispersion may also reduce the risk of Avian Influenza (H5N1), which has been reported in Mansehra and NWFP. There is very little value addition in the industry; most poultry are slaughtered in open and unhygienic markets. Other areas for expansion include frozen poultry, already exported to Pakistan's neighbors from France and Brazil; but Pakistan's cost structure makes the industry uncompetitive regionally and globally.

Inland Fisheries and Aquaculture

Inland fisheries and aquaculture are primary industries that can add value and create jobs in rural areas. Pakistan could use fish meal in animal feed rations and employ ocean, river and stream options of warm (e.g. near the Indian Ocean, lower Sindh and Balochistan provinces) and cold waters (e.g. AJK, Balochistan, NWFP, parts of Punjab). Raising saltwater and freshwater prawns and crayfish seems largely unexplored in the area of aquaculture.

Farm Forestry

Pakistan has only 9 percent forest cover (Table 4-11) and environmental sustainability is in question. USAID could provide systematic support for rural and plantation forestry. Rural

forestry support could include tree planting to enable watershed management and to provide wood for fuel, construction, pulp and other purposes (e.g. veneer, nitrogen fixation)—and to collect carbon credits. With regard to credits, USAID's TIST programs in India, Kenya, Tanzania and Uganda are innovative. Modalities would need to be developed for Pakistan, but such programs hold excellent potential for roll out via communities and NGOs, and for involving women. Support for plantation forestry could include exploring national options for native species and other beneficial species (e.g., those that can contribute to greenhouse gas emission carbon credits; to nitrogen fixation). The private sector could be involved in both types of forestry support, though it will take time to work out modalities. Land use is important, and the government may need assistance in developing options, legislation, and other support to make initiatives work.

Table 4-11
Pakistan's General Geography, Area, and Forest Cover

Category	Hectares
Plains	20,580,000
Mountains	66,487,000
Total	87,067,000(other figures show 87,890,000 ha.)
Area forested	8,175,000 (9 percent)

SOURCE *Planning Commission of Pakistan, 2007, from Forest Department, and quoted by Bureau of Statistics, Pakistan. Data reviewed August 2008.*

CROSS CUTTING ISSUES

Given the wide variation in farm sizes and other influences in Pakistan, any program will need to work on multitude of fronts. Enterprises servicing markets will cater to different sub-markets. For example, as part of a national agribusiness strategy, the program could include "NGO agro-enterprises" as was done in earlier USAID programs in Bangladesh. NGOs provide low cost sources, maintain quality assurance, and are good at reaching poorer and smaller farmers directly without public or private sector interventions. Similarly, current traders need guidance on vertical integration and strengthening operations. This does not preclude a range of service providers to the larger entrepreneurs, or partnerships such as for sales.

NGOs, Grower Groups, and Associations

NGOs, grower groups, and grower associations can be vehicles for communication, training, and long-term collaboration. NGOs working in Pakistan's rural sector rely heavily on donor programs. Here, the examples of the BRAC and the Grameen Krishi Foundation in Bangladesh are instructive. In working in the agriculture sector, both NGOs had to accept commercial work, including profit and loss, even though they were not for profit. Once they accepted the commercial orientation they made progress.

Grower groups in Pakistan are considered part of the informal sector because they may not be legal entities, but they can be part of the supply chain. Contractors, for example, can work with grower groups to considerable mutual benefit while minimizing mere opportunism. Over time,

informal associations can evolve into legal entities. Associations include the Seed Companies Association of Pakistan (SCAP), the Flour Millers Association of Pakistan (FMAP), the Rice Exporters Association of Pakistan (REAP), the Feed Millers Association of Pakistan (FMAP), and the Pakistan Poultry Association (Punjab Zone) (PPA). Each could be engaged in dialogue with the government on agriculture sector governance. Most groups, including trader groups, have a peak national body and chapters based on Pakistan's administrative structure. With support and mentoring all can, over time, evolve into positive voices for sector development. SCAP, for example, could become the "Pakistan Seed Industry Association" and have as members multinationals, national companies, smaller family or sole trading enterprises, consultants, and service providers. Chambers of commerce should be scrutinized to ensure they are not de facto government organizations.

NGOs, which regularly implement donor-funded projects, tend to react to rather than anticipate national, market, or donor demands. Still, they could very well be an important means for implementing any program in rural areas, especially in their ability to reach women. Compared to government and the private sector, NGOs have slower delivery but are more careful and their community mobilizing solutions have worked well with women in earthquake-affected areas. Associations can be strengthened to promote industry and build sector confidence in engaging with the government.

National Rural Support Program

The NRSP could be a venue for improving agriculture input delivery, communication, and information on procurement of crops or other commodities. The NRSP provides loans for land preparation, fertilizer, seeds, crop protection, irrigation water, and animal health products. Fifteen percent of the micro-credit loans are in the livestock sector, where 50 percent of loan recipients are women. The NRSP is linked to other rural support programs, all of which need support in assuming a commercial orientation.

Quality Assurance

The government's regulatory frameworks (e.g. for quarantine, plant protection) should facilitate sector and industry quality assurance. Industry (and public sector agencies) accreditations for agricultural supply and value chains should be encouraged. Accreditations would include meeting ISO and HACCP standards, as well as other standards and best practices. Agribusiness associations should strive to engage with other Asian and international associations.

Banking and Finance

Pakistan has 21 institutions engaged in financing the agriculture sector, ranging from commercial banks and development finance institutions to microfinance institutions. The Zarai Taraqiati Bank Limited (ZTBL) and the Punjab Provincial Co-operative Bank (PPCB)—both government banks—are specialized and five other private banks: National Bank, Habib Bank, United Bank (owned by Standard Chartered Bank), Allied Bank, Muslim Commercial. Banks registered with the State Bank of Pakistan are listed in Exhibit 4-1; some unregistered Microfinance Institutions (MFIs) and NGOs, such as the National Rural Support Program (NRSP), provide rural and other forms of credit (e.g. seed banks; cow banks; advance crop inputs, harvest retention). All banks

follow the State Bank's policy guidelines;[31] some follow Islamic banking practices, but how this affects the agricultural sector is unknown. Informal lending via traders is sizeable. Any USAID program should take into account the *hawala* or *hundi* systems of money transfer and their effect on the agriculture sector, as those systems are implicated in money laundering in the informal sector.

Pakistan's agricultural credit market is close to US$6 billion, with only 35 percent of potential borrowers participating (1.5 million borrowers out of 6.2 million growers). This low rate is attributed to small land holdings and the predominance of subsistence farmers.[32] Pakistan's outstanding agriculture sector credit is US$2.2 billion, of which ZTBL and PPCB have a 50 percent share, and ZTBL has 90 percent of this 50 percent share. The five large private banks have a 35 percent share in the sector.

Large agribusinesses have financing arrangements, but many entrepreneurs and commercial growers are deterred by banks' cumbersome procedures and rent seeking. To learn more about bank operations in the agriculture sector, we directly interviewed the National Bank, Habib Bank and First Women Bank Ltd.

National Bank of Pakistan. With 18 percent of the market, NBP is the largest rural lender. Eighty percent of credit goes to Punjab farmers who have a very low default ratio. Borrowers in Punjab Province are knowledgeable and open to new financial products, and banking staff there are more efficient. The remote bank branches are not online, but every field officer has a desktop computer, each branch has an IT system, and all branches will eventually be connected and online. USAID could consider supporting NBP in staff development and in targeting women borrowers. Bank staff could benefit from training that helps them evaluate supply chain settings, judge loan feasibility, and confirm loans for agriculture and agribusiness. NBP could pilot, with USAID assistance, a program to recruit female bank field officers to better reach female farmers, female heads of households in rural areas, and women-led agribusinesses.

Habib Bank Limited. HBL would like to explore collaborating with USAID in future agribusiness programs. Privatized when the Aga Khan Fund for Economic Development took the majority of shares, HBL has 1,450 branches, about half real time online and half updating via a central databank at night. These branches serve 100,000 farmers, or about 7 percent of the 1.5 million farmer borrowing base. HBL has a unit for retail agriculture and a unit for rural financing of SMEs. This standard organization lacks the flair necessary to serve agribusiness supply chains, add value, network with business groups for mutual benefit, or truly understand supply chains for rural financing. HBL's 300 agriculture finance officers, who have at least a B.Sc Honors in

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[31] Prudential regulations for agriculture available at http://www.sbp.org.pk/publications/prudential/index.htm Agriculture credit information—including credit targets, sector draft guidelines giving options where agriculture credit is / would be extended in Pakistan is found at http://www.sbp.org.pk/departments/acd htm

[32] The State Bank defines small farmers as those holding 12.5 acres (5 ha.) in Punjab, 16 acres in Sindh and NWFP (6 ha.), and 32 acres (13 ha.) in Balochistan.

Exhibit 4-1

Domestic and Foreign Banks and Development Financial Institutions Registered In Pakistan

PUBLIC SECTOR COMMERCIAL BANKS

- First Women Bank Ltd
- National Bank of Pakistan
- The Bank of Khyber
- The Bank of Punjab

SPECIALIZED SCHEDULED BANKS

- Industrial Development Bank of Pakistan
- The Punjab Provincial Co-operative Bank
- SME Bank Limited
- Zarai Taraqiati Bank Limited

PRIVATE LOCAL BANKS

- Allied Bank Limited
- Askari Bank Limited
- Bank Al Falah Limited
- Bank Al Habib Limited
- My Bank Limited
- Crescent Commercial Bank Limited
- NIB Bank Limited
- Faysal Bank Limited
- Habib Bank Limited
- KASB Bank Limited
- MCB Bank Limited
- Meezan Bank Limited
- Atlas Bank Limited
- Saudi Pak Commercial Bank Limited
- Soneri Bank Limited
- United Bank Limited
- Arif Habib Bank Limited
- Dubai Islamic Bank Pakistan Limited
- Bank Islami Pakistan Limited
- ABN Amro Bank Pakistan Limited (now Royal Bank of Scotland)
- Habib Metropolitan Bank Limited
- JS Bank Limited
- Standard Chartered Bank (Pakistan) Limited
- Emirates Global Islamic Bank
- Dawood Islamic Bank Limited

FOREIGN BANKS

- Al-Baraka Islamic Bank B.S.C. (E.C.)
- Citibank N.A.
- Deutshe Bank A.G.
- The Hong Kong & Shanghai Banking Corporation Limited
- Oman International Bank S.A.O.G.
- The Bank of Tokyo – Mitsubishi UFJ Limited

DEVELOPMENT FINANCIAL INSTITUTIONS

- House Building Finance Corporation
- Investment Corporation of Pakistan
- Pak Kuwait Investment Company of Pakistan (Pvt) Limited
- Pak Libya Holding Company (Pvt) Limited
- Pak Oman Investment Company (Pvt) Limited
- Pakistan Industrial Credit and Investment Corp. Ltd
- Saudi Pak Industrial & Agricultural Investment Company (Pvt) Limited

MICRO FINANCE BANKS

- Khushhali Bank
- Network Micro Finance Bank Limited
- The First Micro Finance Bank Limited
- Rozgar Micro Finance Bank Limited
- Tameer Micro Finance Bank Limited
- Pak Oman Micro Finance Bank Limited

Note: ZTBL is the former Agricultural Development Bank of Pakistan. Barclay's Bank has entered the market but is not listed; presumably it will be categorized as a foreign or possibly a private local bank.

SOURCE: :Economic Advisor's Wing, Finance Division. Pakistan Economic Survey 2007-2008. Government of Pakistan, Islamabad. www.finance.gov.pk

agricultural science, are supported by 100 recovery officers who are contract employees compensated on the basis of loan recovery (note the ratio of loan recovery to staff). The State Bank of Pakistan sets agriculture sector loan targets for commercial banks; HBL's target for 2007-2008 was Rs.22 billion. All banks loaned Rs.213 billion, HBL loaned Rs.22.2 billion. The State Bank setting loan targets versus having financing options be market driven is an issue.

First Women Bank Ltd. Established in 1974, this bank has 511 staff in 38 branches reaching 58,000 villages in rural Pakistan. Loans through branches support mainly livestock and horticulture. Half the borrowers are women or companies with 51 percent female ownership. NGOs (e.g. NRSP, SRSP) are key retailers of funds in the bank's portfolio. The bank believes its potential to lend is hampered by an outdated mandate, and it considers the State Bank of Pakistan's procedures very cumbersome. The bank may be "too small" and could be merged with another institution, as the government has raised the minimum capitalization to PKR23.0 billion (effectively a statutory reserve). A range of donors have worked with First Women Bank Ltd., but the bank is cautious toward donors who tend to serve their own purposes then move on (e.g., ILO was mentioned as a negative example). [33]

Donor support for banking is apparently channeled through the State Bank. The Asian Development Bank seconds staff to the State Bank. Funds for an ADB agribusiness program launched in the last quarter of 2008—the Agri Finance Capacity Building Support to Participating Financial Institution—are delivered through the Government of Pakistan and the program is to be executed by Rabo International Advisory Services. Apparently, all banks must participate in the program for "regulatory" reasons. Meanwhile, DFID's Financial Inclusion Programme is intended to enable banks to provide wholesale credit to MFIs for disbursement to micro borrowers in rural areas against a credit guarantee.[34] Private banks interviewed did not mention any other donor support.

With whom should USAID enter into discussions over possible assistance to promote agribusiness and rural lending? Initially, at least, NBP, HBL, United Bank, Allied Bank, and MCB. HBL and MCB seem to the most aggressive. National Bank has the most extensive branch structure and while ZTBL and PPCB are active in lending they may be politically directed.

While it is too early to speculate on the outcome of ADB's agribusiness support, Rabo Bank, which specializes in agribusiness finance, may be worth supporting in taking over, for example, ZTBL and PPCB to unlock the potential of agribusiness lending in Pakistan (e.g., Rabo purchased the Agricultural Development Bank in Australia). Or USAID could assist U.S. banks with a similar mandate and portfolio in forming joint ventures with one or more of the top five banks. Most banks would welcome advice and assistance with organizational issues, and newer bank employees, though keen for innovative and positive ideas, "don't know what they don't know." In this context, assistance to promote agribusiness lending could include

- Training for bank managers in agribusiness and agricultural economics or related fields.
- Training in targeting agriculture subsectors, and devising products that target rural or gender aspects of the subsectors.

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[33] Other banks, such as MCB, are also considered progressive; and ZTBL has male and female credit officers (some husband and wife teams) travel together on motorcycles in rural areas.

[34] The minimum lending size to individual borrowers under this program should be evaluated; representatives of First Women Bank, for example, consider loans below PKR300.00 as too low to have any meaning in Pakistan for even a rural woman.

- Assistance in adjusting lending criteria to focus less on land size and more on ability to repay to promote lending to entrepreneurs and innovative borrowers.
- Sponsoring with a lead agribusiness bank or banks online agribusiness courses developed by Pakistan universities. The courses would target agribusiness professionals, growers (particularly land owners who have never studied agriculture or agribusiness), and bankers to build general capacity in Pakistan on agribusiness.

Investment

The government's BOI is the official vehicle for facilitating foreign and domestic investment, joint ventures, and sector growth. The BOI provides investors information and assistance in coordinating with government departments and agencies. Its contact in MINFAL is the Additional Secretary responsible for investment. The BOI also evaluates applications of investors for the Work/Business Visa, Branch/Liaison Office and Security clearances, although some foreign investors find the Board ineffective in this role.[35] Though the BOI has four divisions—agriculture, automobiles, power, oil and gas—it takes a regional focus when contacting investors (e.g., Europe). And though the Board has a central databank it lacks a management information system, which makes it difficult for potential investors to get information that helps them make sound decisions. USAID could help develop agribusiness investor advisory services at the BOI. With such services, the BOI could raise its profile, facilitate links to MINFAL across sectors and among stakeholders, and engage with similar agencies and industries outside of Pakistan.

Credit to Enhance Women's Participation

In general, women's legal status (e.g. female headed household, land owner, tenant, share cropper, lessee) needs firmer definition to ensure basic rights, financial and otherwise. This could begin, first, with raising awareness of women's rights through outreach (including literacy training) for women and men in urban and rural areas and for community leaders and institutions that administer justice (e.g., magistrates, lawyers). Community leaders could be effective change agents, but this would need to be confirmed in each community.[36] Second, laws on succession, matrimonial property and related matters should be harmonized to conform to principles of gender equality. Most important, laws should be simplified to make property rights "automatic," less costly and resolved at the district level or other appropriate administrative level. Co-ownership of matrimonial property and land joint titling / registration should be pursued. Any program design team should include at least one woman familiar with rural Pakistan and agribusiness supply and value chains.

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[35] For example, expatriate staff from BOI who established business have had to return to their home countries to get work permits and visa renewals when they should have been able to complete formalities in Pakistan.

[36] In USAID's Improving Livelihoods and Economic Growth program, in earthquake affected areas, the community mobilizer was very successful in engaging women in community or other groups and then mobilizing resources.

Land Tenure and Property Rights

Land title or legally valid leases encourage investment when they are clear and enforced. In Pakistan, land administration is not transparent and the rights of tenants, share farmers, and farm renters are uncertain. Examples of abound of influential persons claming land allocated to government entities and of politicians settling persons on public land in exchange for votes. Many growers renting farms lack genuine rental documents and have no right to challenge unscrupulous or absentee landlords, who also lose out though they rarely understand this. Consequently, there is little private investment in land and natural resources. Absentee landlords and landlords with no affinity for agriculture, short-term rural land rental markets, and inefficient government departments and parastatals—many of which have "farms"—all discourage long-term investment in land or responsible approaches to the ravages of water scarcity. And under the laws of inheritance, land subdivision is continual to the point that land units are reaching uneconomical sizes. Moreover, those who want to leave agriculture find doing so difficult because they do not have valid deeds.

At some point the government must address these issues, primarily by ensuring all persons inheriting land have title and the choices that titles make possible (e.g. lease, sell) when investment is not possible (e.g., convert broad acre to intensive horticulture). Land reform cannot be deferred indefinitely.

Women make up half the population and head 30-35 percent of rural households in Sindh Province, but how many women are in the agricultural labor force or hold land title, singly or jointly, is not clear. Most women rely on marriage and male kin for access to land and property, and general poverty, high land costs, and custom limit women's involvement in land markets. Insecure tenure for women and youth constrains their creditworthiness and investment potential, curbing their participation in agricultural improvement.

Options for USAID support include commissioning land tenure and property rights studies as a basis for long-term interventions. For example, developing positive interventions to ensure female headed households are not disenfranchised when family status changes requires in-depth review of land titling, land tenure and property rights criteria.

Human Resource Development and Business Services

Commercial growers and agribusinesses face a shortage of literate, capable workers and staff with some level of educational attainment, whether through vocational, trade, and training institutes or universities. The Provincial Agriculture Extension Departments do not support smaller growers, sharecroppers, tenants, or the landless. The private sector wants to engage growers but is loath to allocate resources. For commercial growers, farmer field schools provide a good venue for cultivating the skills and knowledge necessary to manage farms and build supply chains.

With 9,000 students—a third of them women—the University of Agriculture, Faisalabad, Punjab Province (UAF) offers 45 programs in agriculture, agricultural economics, agricultural engineering and technology, animal husbandry, veterinary sciences, and sciences. UAF is largely funded by the government with about 35 percent of its budget met through its own resources. UAF has MOUs with international universities and institutes for exchange and other collaboration

programs, such as research on postharvest issues in the mango supply and value chains through the ACIAR Agriculture Sector Linkages Program. UAF representatives believe that Pakistan's national agriculture research is poorly coordinated between federal and provincial departments, and that the sector sorely needs R&D investment, especially in plant breeding and trait introduction.

Agribusinesses, rural or urban, need business advisory services related to R&D; production; product and market feasibility studies that lead to bankable proposals; enterprise and human resources; quality assurance; and accreditation. Some services are already being provided, but could be greatly improved, while others could be provided through universities or joint ventures with foreign entrepreneurs.

Farmers are facing a labor crisis that can be overcome, at least partly, through mechanization. MINFAL's Agriculture Policy Institute should evaluate costs of production and propose realistic alternatives. Postharvest technology is needed to reduce losses and a strong marketing system has to be in place to sell farm produce.

Communication, Governance, and Civil Society

Modernizing Pakistan's agriculture sector will entail clear communications, sound governance and participation of civil society. The country needs a civil society organization to help clarify the roles of all participants in the agriculture and natural resources sectors. One would do well to support such an organization in working with the government, stakeholders, and donors in refining a sector vision for national agriculture strategy and promoting best practices (international and regional). The organization could anchor the sector's vision and orientation for the long term and put it on equal footing with other Asian countries, while striving to resolve a host of problems related to extension services, including weak communication between researchers and extension service providers. Public and private providers rely on "contact farmers," which limits information sharing. In addition, extension systems offer competing, conflicting and overlapping programs. Public extension services favor educated farmers and may be unduly influenced by political concerns; private providers favor profit-driven, resource-rich farmers. Commercial growers excluded from public or private extension often seek information from input dealers or commodity traders who may not be well informed or motivated to provide appropriate assistance. Simply privatizing extension will not help most farmers.

Specific areas of support include training dealers and traders in relaying information to growers; improving the communication skills of professionals working in agriculture and related areas; developing a pro-NGO strategy for advancement in rural Pakistan, while obliging NGOs to concentrate on sustainable solutions from the start; and working with the private sector to improve general operations. Support to the public sector should be contingent on institutional reform and a stakeholder acceptance of a national vision for a modernized agriculture extension service.

RECOMMENDATIONS

In response to the challenges and opportunities found in the four agriculture value chains, we conclude, first, that the input and output value chains for all crops need to be stronger. We single out the seed sector for special consideration as it influences crop production technology and agricultural mechanization. Second, rice productivity should be improved as well as the reputation of Pakistan's exports of basmati and coarse rice. Third, predictions of future national needs for maize should take into account the needs of livestock. Fourth, domestic production of oilseed should be increased to include new crops and gradually reduce foreign exchange outflows. And fifth, the government should take a "least interference" stance in regulation while working to strengthen industry and promote private sector leadership, especially in the wheat market.

General

Use the national agriculture strategy as a program framework. Pakistan's national agriculture strategy may be a suitable framework for USAID sector programming. Open discussion of privatizing parastatals in the agriculture and natural resource sectors—where they disrupt private sector activity—is urgently needed.

Aim to strengthen supply chains at each link. USAID/Pakistan's agricultural programs should strengthen supply chains to add value at each link, promoting market-oriented and private-sector led approaches. Prefeasibility and feasibility studies should be conducted for specific product chains, growers coached to prepare accurate gross margins, business plans prepared and regularly reviewed for all enterprises. Related performance criteria should be applied to implementing partners/sub-agreement partners.

Base programs in supply chain studies. Studies will provide benchmarks, goals, and take into account such program success criteria as ability to replicate success and achieve gender equity (e.g., pilot subsector supply chain activities in horticulture or livestock could be compared by location).

Evaluate legal and practical implications of programs. Discern, for example, how willing stakeholders are to engage in production of long-term crops such as olive, fruit, or edible nut or forestry trees. Such programs may entail big investment in devising supply chain approaches, developing business advisory services, establishing operations and management, and training (assessments, master plans, and training periods). Again, the roles of implementing partners must be very clear.

Build in quality assurance and IT solutions. Beneficiaries (recipients of rural produce) can be linked to other stakeholders (e.g. quality assured agricultural inputs, postharvest and agribusiness, rural credit) to obtain sustainable results in agriculture, horticulture, livestock, forestry and non-farm production, and to build a common IT platforms for product traceability and information sharing.

Build on strengths and mitigate weaknesses. Future programming can assist the private sector. The government and other stakeholders can work on agriculture, horticulture, livestock, forestry,

adding in investment in natural resources and watershed management and water harvesting with irrigation, land use planning and enforcement, LTPR administration, strengthening agribusiness functions in the banking and finance sectors, to show that success can be achieved by working across sectors.

Develop human resources. Training is urgently needed in managing farms and businesses. Training assistance can be channeled through industry associations, farmer field schools (FFS), and other groups and can include adult literacy and gender balanced training. Related curricula and accreditation should eventually be incorporated into formal institutional at the national and provincial level. USAID/Pakistan beneficiaries also need training to help them appreciate economics; product, market and enterprise development; quality assurance; marketing; operational, short, medium and long term planning; financial management; and IT.

Build capacity for agribusiness banking among providers of rural credit (e.g. commercial banks and MFIs). There seems no benefit to supporting public sector banks unless they can be privatized or converted to truly commercial entities.

Support infrastructure investments. Such investment can spur agribusiness success. Public sector projects involve general infrastructure (roads, airports, railways, ports), and specific agriculture systems (irrigation systems, cold stores or abattoirs, forests). Private sector projects may involve farm dams, farm sheds, dairies, packing sheds, and processing plant. USAID should consider supporting infrastructure work, perhaps enabling entrepreneurs to pursue possibilities for build, operate, and transfer (BOT) by matching grant funding.

Develop national communication strategies to improve governance. National communication strategies should be developed to disseminate agreed strategic directions and to give civil society a voice in issues in the agriculture and natural resources sectors.

Support transparency and equity. Continue strengthening links between land, water and investment for sustained economic growth in agriculture, forestry (including restitution) and natural resources. This may include a supporting framework with a strong watchdog civil society or community based organizations (NGO, CBO) mechanism.

Women and Youth

Strive for gender balanced implementation. Programs should engage and work with women in rural areas, promoting sustainable solutions from the start.

Raise awareness of the importance of will writing. Support training on and widely support the writing of wills (including statutory declarations). The need for such support among tenant growers, those leasing or sharecropping land, and those investing in perennial crops is urgent.

Promote documentation of overriding interests on title deeds to protect investments by wives and children/youth on family land. This should be a goal in all USAID/Pakistan programs involving agriculture, natural resources, rural growth, and enterprises. Such documentation can help in securing bank loans even for tenant farmers.

Land Tenure and Property Rights

Target deed holders. All USAID/Pakistan programs should start capturing statistics on land tenure and property rights so they can work only with farmers or groups that have land title deeds (freehold, long term lease or rental) registered with the appropriate government office. While this will leave out those without titles, it will target technology innovators and early adopters who will become technology transfer agents.

Remedy irregularities in land tenure and property rights. Irregularities from Partition have not been addressed and there are options for remedying injustices in keeping with broad agriculture policy that enables a productive and responsive sector. Land titling units should establish working groups to include representation from ministries, departments, NGOs, the private sector, and civil society.

Support harmonization of land tenure and property rights. Pakistan's national land policy should be harmonized with other policies (e.g., those for industry, investment, population control) and arise from wide consensus among stakeholders, including those in provinces and in rural communities.

Program Design Allocation

Given possible program budget allocations for a five-year program, funds could be allocated as follows:

Policy—5 -10 percent. Allocations could be 'less' or 'more' if this area includes support for capacity building and facilitation to implement policy.

Rural infrastructure—5 percent. Overall, infrastructure investments relate to policy issues at the federal and provincial level, and existing funding commitments. Options could include what are possibly more public sector roles such as farm-to-market roads, although any investments should be to encourage the private sector, and could include grant funding for infrastructure such as grain handing and storage to show directions, modern rural markets, etc. The program design team should have a rural infrastructure specialist with agricultural engineering skills on its team should USAID decide to invest in these areas.

Irrigation—35 percent. The study needed a clearer mandate as findings were more on the Indus river system, and little on upland issues – from where the water originates. A challenge is to incorporate water management, savings, and new technology. The program design team should have a soil and water irrigation specialist with infrastructure skills on its team should USAID decide to invest in soil, water and irrigation.

Ag sector value chains—50 percent. Allocated to ranked chains: (1/2) wheat/livestock, (3) oilseeds, (4) horticulture, (5) rice, (6) maize, and (7) sugarcane (Pakistan should be encouraged to move out of this crop over time, and this will free up water for other productive areas).

Seed—5-10 percent. Seed is a cross cutting input.

5. Agricultural Policy Issues

On the basis of our review of background documentation provided by the USAID/Pakistan and conversations with knowledgeable Pakistanis inside government and in the private sector, we have chosen to focus on four policy issues: wheat and flour, water, knowledge chains, and the rural business climate. For each we discuss problems—and sometimes potential allies and opponents of policies advocated here—and recommend ways for USAID to address these problems.

WHEAT AND FLOUR

Wheat is Pakistan's most important food crop. It accounts for about three quarters of food grain production and is sown on about 8 million hectares, over a third of all cropped land in Pakistan. Because of the symbolic and practical importance of wheat and flour—as much as 30 percent of consumption basket of the urban poor is flour—they are major exceptions to the government's general commitment to market price regimes for food and food crops.

Governments have acted (or at least wished) to hold down flour prices and to avoid large and persistent imports of wheat. Significant steps were taken to liberalize wheat markets from the late 1980s to 2000. However, after consecutive relatively poor wheat harvests from 2002 to 2004 led to high market prices, the federal government, as well as the government of Punjab, applied several policy measures to increase supplies, add to government stocks, and stabilize prices, including restricting transport of wheat and subsidizing sales of government imports. The low international prices for wheat limited damage from these measures.

To accomplish the competing and sometimes contradictory objectives of producing enough wheat to satisfy local demand and holding flour prices down, the government has for decades had in place a system of "procurement price" for wheat purchased from farmers and an "issue price" at which wheat is sold to flour mills. Although justified as a mechanism for preventing middlemen from exploiting farmers, the procurement price has generally been less than the landed cost of imported wheat (import parity = 100 percent) (Table 5-1).

The procurement price is decided each year at high political levels based on input from the Ministry of Food, Agriculture and Livestock (MINFAL). MINFAL attempts to estimate a cost of production for wheat and to set a price that will elicit a response that will permit the government to purchase enough wheat for "strategic" and "operational reserves," which are also estimated. It is not clear to what extent, if any, expected international prices of wheat bear upon these decisions. Purchases of the target volumes are carried out by the Food Departments of the

Provinces of Punjab and Sindh and the Pakistan Agricultural Storage and Supplies Corporation (PASSCO). Each entity is assigned a portion of the overall procurement target. The provincial governments sub-allocate their targets down to the district level. The two provincial governments procure within their own provinces. PASSCO procures mainly in Punjab, the only province that normally has a surplus. The Pakistan Trading Corporation may also be instructed to procure wheat internationally; in 2007/08 it purchased 2.4 million MT.

Table 5-1
Procurement Prices and Import Parity Ratio

Year	Pakistan Import Price	Procurement Price		Issue Price (April)	Procurement/ Import Parity Ratio (%)
		Rs/Mound	$/MT		
2002/03	201.60	300	128.34	345	64
2003/04	199.43	350	149.57	345	75
2004/05	191.85	400	168.47	398	88
2005/06	203.85	415	173.33	425	85
2006/07	259.32	425	175.23	430	68
2007/08	444.11	625	254.37	625	57
2008/09	429.98	1100	361.84		84

SOURCES

Procurement prices—PAASCO

US export prices 2002/03-2007/08—www.ers.usda.gov/Data/Wheat/Yearbook/ WheatYearbookTable20-Full.htm.

US Export Prices 2008/09—CBOT March 09 contract (www.cbot.com/cbot/pub/page/0,3181,1322,00.html)

Freight—Drewry Shipping Consultants/O'Neil Commodity Consulting (www.ams.usda.gov/AMSv1.0/ getfile?dDocName=STELPRDC5070849)

Wheat purchased under this system is then sold to flour mills at an issue price. As the issue price is close to the procurement price and below the market price, mills may not purchase as much as they wish but according to a quota based on milling capacity. Mills are supposed to resell the flour purchased under quota at cost plus a thin milling margin, but it is widely believed that they resell at a higher margin so that milling of “issue” wheat is highly profitable in most years. Some mills operate on nothing but “issue” wheat. Others do to operate at all, but sell their quota to other mills.

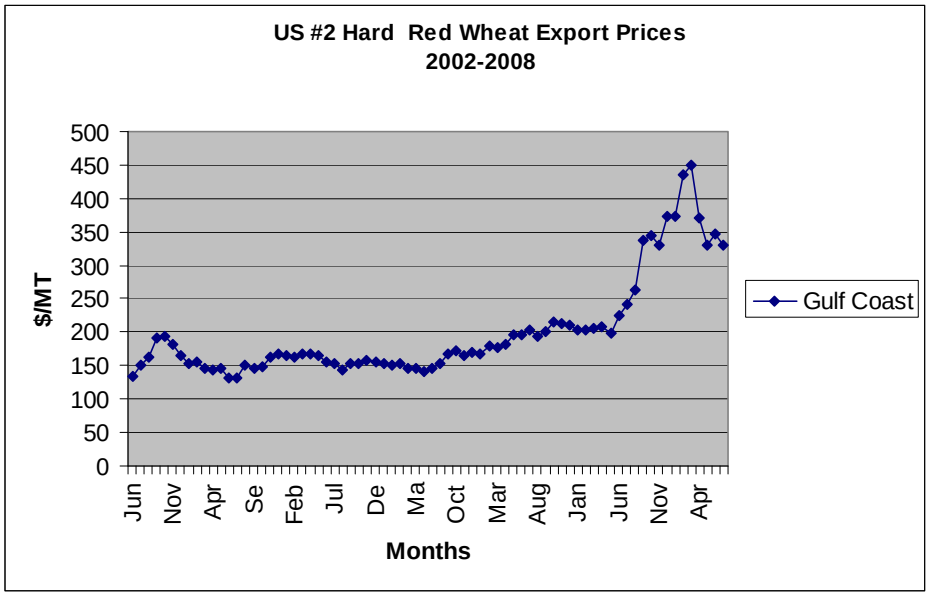
The recent run-up in international wheat prices took a system that, while problematic, was more-or-less working and pushed it toward chaos. In the 2007/08 season with the procurement price at Rs 625/maund,[37] the import parity fell to 57 percent.[38] In fact the procurement price first

[37] The “maund” is a traditional measure of volume similar to the bushel. Its weight of wheat is taken to be 40Kg.

[38] Calculation of this “parity price” does not necessarily imply that a market price of wheat in Pakistan would be governed most years by the price of imports. As will be argued later, with a proper policy set, Pakistan could be a net exporter of wheat, implying that prices would settle somewhere between the import and export price.

announced of just Rs 510/maund, if left unchanged, would have meant an import parity ratio of 47 percent, less than half of world prices. At the time fieldwork for this report was being carried out, discussions were underway to fix the procurement price for the 2008/09 crop year. Sowing for the dry season (rabi) crop begins in October. Prices in the range of Rs 800/maund to 1100/maund were mentioned. The former would likely leave the import parity virtually unchanged at the 2007/08 level.[39] The latter would raise the import parity to the levels of 2004-2006.[40]

Figure 5-1
US#2 Hard Red Wheat Export Prices, 2002-2008



Pakistani officials and other observers have identified a number of drawbacks in the wheat procurement and issue system, which may be characterized as an untargeted subsidy to flour consumers financed in large part by a tax on wheat producers:

- Farmers have little incentive and ability to produce more. In all of Pakistani agriculture farmers using modern inputs obtain much higher yields, but this productivity gap is particularly great in wheat. From 1990-2006, wheat yields grew by about 1.3 percent per year; yields for maize, whose markets are not subject to mandatory procurement, increased on average by 3.8 percent per year (Figure 5-2). Although low farm-gate prices for wheat are not the only reason for this relative backwardness, it surely contributes to this outcome.

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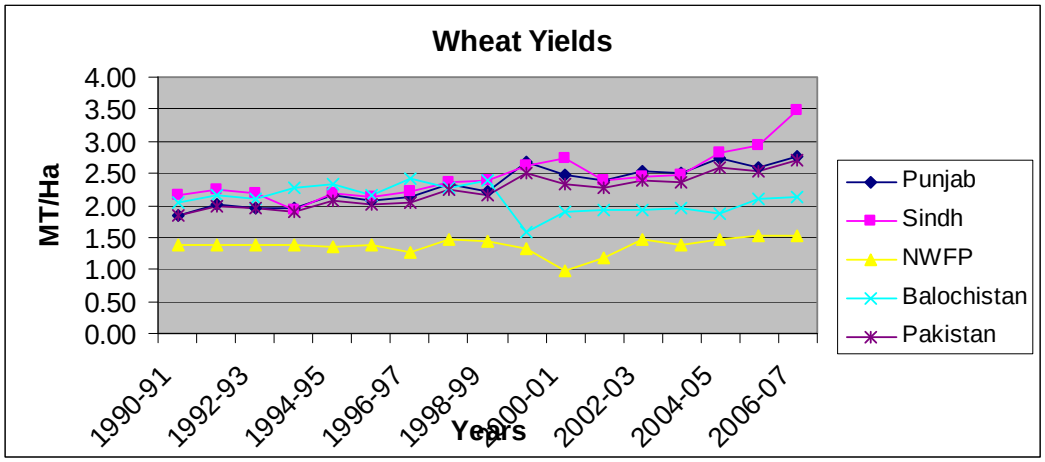
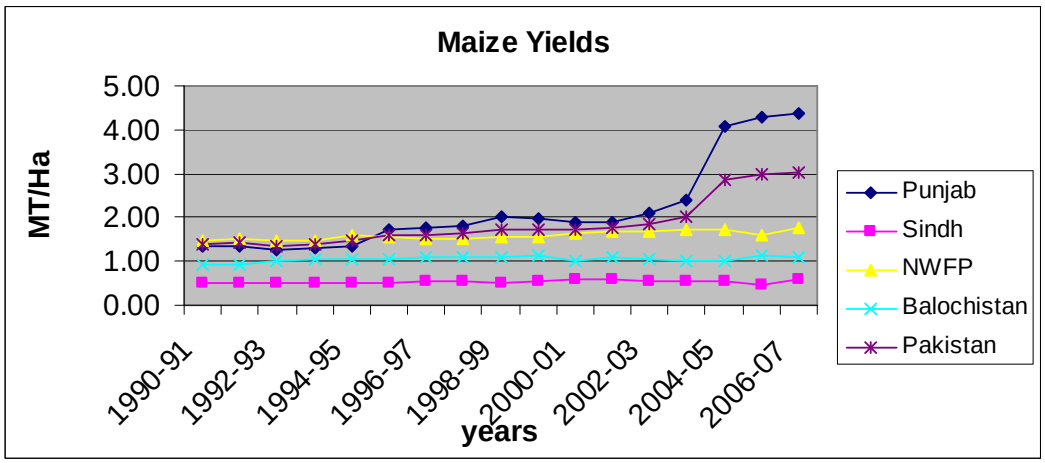
[39] Based on the Chicago Board of Trade March 2009 wheat price and estimates of current freight rates from US Gulf ports to Pakistan.

[40] As it is argued that Pakistan with good policies could become an exporter of wheat, one might ask why the "export parity" is not a more relevant comparison. Exports in the Pakistani context mean exports to its hinterland in Afghanistan with some transshipments to Eastern Iran and the nearer "stans." Prices in these markets are probably set by the price of imports so "export" prices in Pakistan are probably closer to import prices than to prices Pakistan would be competing with if it were truly exporting to a world market.

Figure 5-2
Wheat and Maize Yields, 1990-2007





- Inefficient handling and storage, and post-harvest losses. Wheat procurers have incentives to purchase specific volumes, not to preserve and increase value in what is essentially a trading activity. This results in procurement of low quality wheat and high handling costs.
- In most commercial activities the private sector has proven superior to the public sector. Yet, given the role of the government, additional private investment in wheat marketing, transport, and storage cannot be expected.
- In most years government is not able to procure targeted volumes at the pre-set procurement price.
- On the margin, additional milling capacity translates into a higher quota of wheat at the subsidized issue price which can be resold profitably; each flour mill has an incentive to over invest in capacity even if it will not be used. The aggregate result is that mills run at about 30 percent of capacity (reported percentages vary) while millions of dollars of excess capacity remain idle.

- Especially in years such as 2007-2008 when the procurement price was far below market levels the effort by provincial governments to procure the targeted quantities creates a "need" for bans or administrative restrictions on inter-district/interprovincial procurements of wheat. Measures were also introduced to prevent flour mills from storing more than about two weeks' worth of production. These ad hoc measures are a further disincentive to private investment in wheat marketing and storage.
- The logic of the tax/subsidy system demands a ban on legal exports of wheat from Pakistan into Afghanistan while creating an incentive for clandestine movements, estimated at 2.3 million MT in 2007/08. Press reports hint that the Taliban have gained a role in regulating and taxing these clandestine movements.

Many of the system's drawbacks arise from its inherent inconsistency: one cannot maintain a ceiling on the price farmers receive while purchasing a predetermined amount of wheat to be subsidized.[41] Notwithstanding the structural flaws in the system, Pakistan has remained a marginal importer/exporter of wheat. It is reasonable to suppose that a movement toward less government control of wheat marketing complemented by other productivity enhancing measures could make Pakistan a reliable supplier of wheat to Afghanistan and to some distances beyond. Government officials estimate that even a small reduction in the gap between what the yields of the best farmers and average yields would make Pakistan a consistent new exporter.

WATER

If wheat and flour pricing policies are the most urgent problem facing Pakistan's food and agriculture system, water is the most important one.[42] Pakistan is perhaps the world's most arid high-population country.[43] The population and the economy are heavily dependent on an annual flow of the "Five Waters" (panch ab = Punjab) : the Indus, Jhelum, Chenab, Ravi, and Beas-Sutlej rivers. These provide about 180 billion cubic meters of water whose origin lies in neighboring countries and is mostly derived from summer snowmelt in the Himalayas. With the advent of large-scale irrigation technology in the 19th century, the Indus irrigation system became the largest contiguous irrigation system in the world. Without this system agriculture in Pakistan would scarcely exist.

Pakistan is already one of the world's most water-stressed[44] countries and is headed for water scarcity,[45] possibly by 2035, because of population growth (Table 5-2). And there is nothing to be done about it; there is simply no additional water to be injected into the system. Indeed, overall

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[41] This is often called the "Tinbergen Principle" for the Dutch economist Jan Tinbergen, the first recipient of the Nobel prize in Economics in 1969.

[42] Much of this section draws heavily from the World Bank's Pakistan Country Water Resources Assistance Strategy, 2005.

[43] Egypt is also water scarce, but because of the Aswan High Dam, water supply from the Nile predictable, unlike the Indus.

[44] Less than 1800 M^3 per capita per year.

[45] Less than 1000 M^3 per capita per year.

use for irrigation must decline if there are to be adequate flows into the degrading delta. Compared to the long-term average of 103 million acre feet million acre feet (MAF), surface water availability in recent years has between 5 percent and 20 percent below the long-tem average.

Table 5-2
Water Availability in Selected Countries, 2000

Country	Total Renewable Resources (cubic km)	Withdrawal for Agriculture	
		Cubic km	Percentage of Renewable Resources
Egypt	58.3	53.85	92
Pakistan	222.7	162.65	73
Afghanistan	65.0	22.84	35
India	1,896.7	558.39	29
China	2,829.6	426.85	15
Mexico	457.2	60.34	13
Bangladesh	1,210.6	76.35	6
Argentina	814.0	21.52	3
Colombia	2,132.0	4.92	0

Source FAO AQUASTAT.

Aggregate shortage is not the full extent of Pakistan's water problem. Approximately 15 million tons of salt—a minor component of all fresh water—are accumulating in the Indus Basin every year from evaporation, as little water reaches the sea. Without sediment, the Indus delta is degrading rapidly, with profound consequences for people and the environment.

Groundwater, which now accounts for about half of all irrigation is being overexploited in many areas, and its quality is deteriorating as saline water is invading over-pumped freshwater aquifers, yet tens of thousands of additional wells are being put into service every year. In the *barani* areas of Balochistan, farmers (using subsidized electricity) are pumping from depths of hundreds of meters and in the sweet water areas of the Indus Basin, depletion is now a fact in all canal commands. Furthermore, there are serious and growing problems with groundwater quality, a reality that is likely to get worse because of salt accumulation. There is an urgent need to bring withdrawals into balance with recharge; and since much groundwater recharge in the Indus Basin –about 80 percent—is from canals, this requires an integrated approach to surface and groundwater.

As if growing water demand colliding with static supply, salt accumulation, and degradation of the Indus delta were not enough bad news, climate change will pose even harsher challenges to Pakistan. The Indus basin depends heavily on the glaciers of the western Himalayas, which act as a reservoir, capturing snow and rain, holding the water and releasing it into the rivers which feed the plain. It is now clear that climate change is already affecting the western glaciers far more seriously than in the damper Eastern Himalayas. While the science is still in its infancy, best estimates are that there will be 50 years of glacial retreat, during which time river flows will

increase. But then the glacial reservoirs will be empty, and there are likely to be dramatic decreases in river flows conceivably by a terrifying 30 percent to 40 percent in 100 years time.[46]

Even in the shorter term much of the water infrastructure is in poor repair. Because of a combination of age and what has aptly been called the "build/neglect/rebuild" philosophy of public works, much of the infrastructure is crumbling. This is true even for some of the major barrages, which serve millions of hectares and where failure would be catastrophic. There is no modern asset management plan for any major infrastructure.

In large part, irrigation infrastructure is falling apart because the system is not financially sustainable. In Pakistan, users of canal water pay a very small part of what the presently configured institutions require for rehabilitation and maintenance of the assets and for operations. The rest is basically paid by the taxpayer. And much of what is spent goes for payment of overstaffed bureaucracies whose appetite leaves insufficient funds for system maintenance and operation. This reality gives rise to a vicious circle in which users are not willing to pay for poor and unaccountable services, funds for operations and maintenance are insufficient, service quality declines, and users are even less willing to pay for ever poorer service.

Although Pakistan's irrigation infrastructure is vast, almost all of it is for diverting annual flows from North and West to South and East. Storage of water per capita in Pakistan is miniscule, 150 M^3, compared to Egypt at 2200 M^3 or the United States and Australia at over 5000 M^3. Put another way, the dams of the Colorado and Murray- Darling Rivers can hold 900 days of river runoff, South Africa 500 days, India 120 to 220 days. By contrast, Pakistan can store barely 30 days of Indus water. And with the high silt loads from the young and still growing Himalayas (about a foot and a half per century), Pakistan's two large reservoirs are (as predicted at design) silting relatively rapidly. About 10 percent has already been lost.[47]

The final piece of bad news, but one that holds considerable hope for improvement, is that water productivity in Pakistan is low, as would be expected where users pay less than the cost of supply. Large parts of Pakistan have good soils, abundant sunshine, and excellent farmers. And yet crop outputs, both per hectare and per cubic meter of water, are much lower than international benchmarks, and much lower even than in neighboring areas of India. Aggregate water use per Rupee of output is correspondingly higher. As seen in Table 5-3, output of sugarcane, a crop that needs four times as much water to produce a Rupee of output as wheat, has been growing almost twice as fast as the staple grain. The quality of water service and the fact that water users do not pay anything approaching the scarcity value of water play an important role in inefficient use: yields from reliable, self-provided groundwater (the operations and maintenance of which are not subsidized except in Balochistan) are twice those of unreliable and inflexible canal supplies. With

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[46] Snow and Glacier Aspects of Water Resource Management in the Himalayas, DFID Kar Project R7980 http://www research4development.info/PDF/Outputs/Water/R7980-final-report-volume2.pdf

[47] Few countries have as much unexploited potential for hydropower as Pakistan. Some 86 percent of the 50,000 Mw of Pakistan's economically viable hydropower potential has yet to be developed.

all the problems of the existing system, a better choice of crops could have a high payoff and allow time for long-term measures to be put in place.

Table 5-3
Comparative Water Intensity of Selected Crops in Pakistan

	Rs/Ac in[a]	Intensity Index
PUNJAB		
Canola	1708.538	0.909
Wheat	1553.250	1.000
Seed Cotton + Wheat	1288.588	1.205
Seed Cotton	1156.500	1.343
Seed Cotton + Sunflower	981.886	1.582
Basmati Paddy + Wheat	565.729	2.746
Sunflower spring	538.182	2.886
Basmati Paddy + Sunflower	487.400	3.187
IRRI + Wheat	467.000	3.326
IRRI + Sunflower	404.155	3.843
Sugarcane[b]	380.694	4.080
Basmati Paddy[b]	366.069	4.243
RIIRRI Paddy[b]	261.113	5.949
SINDH		
Canola	1421.231	0.940
Seed Cotton	1402.778	0.953
Seed Cotton + Wheat	1376.167	0.971
Wheat	1336.250	1.000
Seed Cotton + Sunflower	1187.750	1.125
Sunflower spring	1011.818	1.321
IRRI + Sunflower	527.256	2.534
IRRI + Wheat	513.250	2.604
Sugarcane[b]	339.155	3.940
RIIRRI Paddy[b]	336.893	3.966

[a] *Ac. in Acre-inch, the amount of water needed to cover one acre with water one inch deep, about 20,000 gallons.*
[b] *Water-intensive crop.*
SOURCE MINFAL.

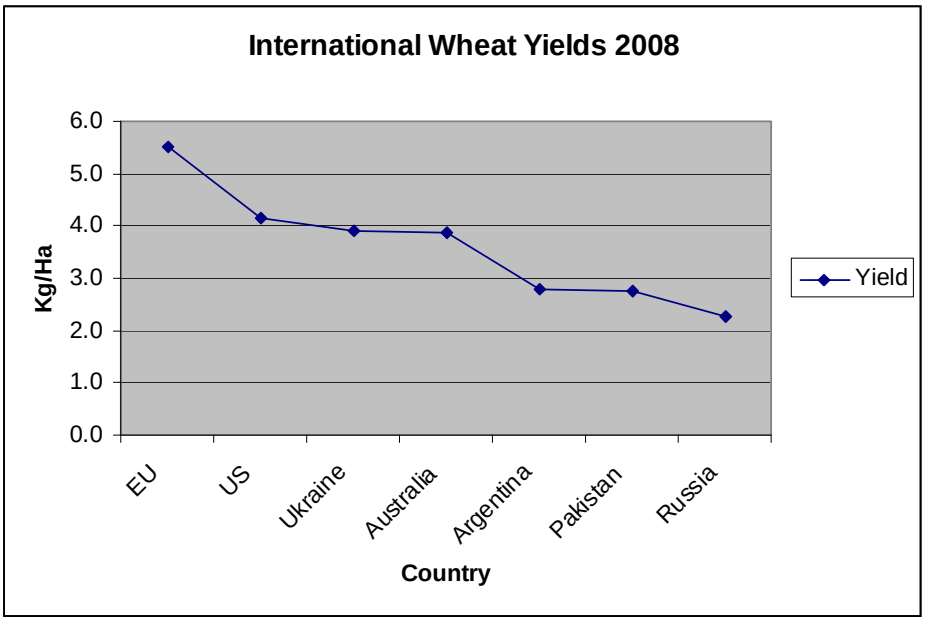
AGRICULTURAL "KNOWLEDGE CHAIN"

Agriculture is humanity's first technological system. It remains today one in which new knowledge is constantly being generated about crop, pests, cultivation practices, and ways to respond to constantly changing market conditions. Agriculture gives rise to "value chains" of market transactions generating income at each step of the way from input supplier to farmer to

processor. In the same way, a "knowledge chain" linking basic, applied, and adaptive research underlies modern agriculture and food systems. Pakistan was a major beneficiary of the Green Revolution of the 1960s, which brought new wheat varieties to Pakistan where they were adapted to local conditions and practices and put into the hands of Pakistani farmers.

Today the model of research and extension has broken down. Spending on agricultural research had declined. Pakistan in 2003 spent about 0.3 percent of GDP on agricultural research, down from about 0.6 percent in 1991. The private sector also funds research[48] but still accounts for only about 6 percent of spending.[49] Only about 5 percent of educational projects go toward agriculture. Limited funding has a disproportional effect on effective research, as a high percentage of total costs goes into salaries, leaving little for equipment and supplies. Research in this environment tends to be of a useful but "maintenance" variety (fending off new pests such as U99 wheat stem rot), rather than productivity enhancing. No new wheat variety has been introduced in Pakistan in the past ten years. By the same token few young researchers are attracted to a stagnant system.

Figure 5-3
International Wheat Yields 2008



As shown in Table 5-4, research is carried out by a number of different institutions—not a bad thing—but researchers report that communication among them is not good, a useful coordination mechanism having been abandoned some years back. In sum, less relevant knowledge is going into the "top" of the chain.

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[48] See the Guard Rice story on page 55.

[49] Nienke Beintema, Waqar Malik, and Muhammad Sharif. 2006. Key trends in Pakistan's agricultural R&D investments.

Extension is the responsibility of the provincial governments but is not working well. Communication with new research (public and private) is limited and funding goes mostly to salaries and not much to making contact to farmers.

Table 5-4
Composition of Public Agricultural Research Expenditures and Total Researchers, 2003

Type of Agency	Spending		No of Researchers
	2000 Rs millions	2000 Int.$ millions	
Federal Government			
PARC	203	17	239
NARC	416	35	500
Other	229	19	286
Subtotal	848	71	1025
Provincial Government			
Balochistan	95	8	169
North-West Frontier Province	138	12	354
Punjab	678	19	1163
Sindh	229	19	468
Subtotal	1140	58	2154
Higher Education	254	21	291
Public Sector Total	2241	188	3.487
Private Sector	238	11	NA
Total	2378	199	

Another often overlooked element in the sector knowledge chain is policymaking capacity. As with other aspects of the sector, responsibility for policymaking is divided between federal and provincial levels and within the federal government between MINFAL and the Planning Commission. None is fully up to the job.

Within MINFAL, support for policymaking is lodged with the Agricultural Policy Institute, formerly the Agricultural Prices Commission. Here one would hope to find the capacity to develop sophisticated crop models, gather and disseminate up-to-date information on prices and outputs, and analyze the effects of prices and climate on the shifting mix of land use and output. Such is not the case. Although the institute has several well trained Ph.D. agronomists (some beneficiaries of earlier USAID-funded graduate studies in the United States), there are few agricultural economists among them. The story is similar at the Planning Commission.

The collecting of agricultural commodity prices, a cornerstone of policymaking, has deteriorated. In principle MINFAL tracks monthly wholesale prices of a large number of commodities, but three—wheat, Basmati rice, and IRRI rice—are published in the annual agricultural statistics. The years 1990-91 to 2006-07 are currently available. Wheat and IRRI rice are tracked in six markets; Basmati in seven markets. Over the 17-year period, either there was no reported price or the price

was reported as unchanged in almost half the market-months.[50] In the past two years, the quality of reporting has declined even further.

Table 5-5
Agricultural Commodity Prices, Percentage No Change or No Report

	1990-2007	2005-2007
Wheat	44	69
IRRI Rice	45	55
Basmati	45	77

RURAL BUSINESS CLIMATE

Land Titles

The ability to freely own agricultural land and to easily transfer and register that ownership is a fundamental requirement of agricultural growth in a free-market economy. Without secure rights to their land, for example, farmers have few incentives to invest and devote fewer resources to defending their rights. Lack of secure title means landowners are less willing to risk renting out land, which in turn reduces access by landless households to land. Problems with land registration and clouds on land title (including leasehold interests) are severely impeding a variety of desirable outcomes: the ability of rural entrepreneurs—especially women—to start businesses and obtain capital; the security of investments in real property; the efficiency and effectiveness of the courts in all civil matters; access to credit; and the overall rural income growth of Pakistan.[51]

The legal and institutional systems relating to land registration and transfer of title are quite slow and costly. The annual World Bank *Doing Business* survey shows a steady decline in Pakistan's ranking for Registering Property: it fell from 57 in the 2006 survey to 97 in the 2009 survey. Registering property requires 50 days and costs the equivalent of 5.6 percent of the value of the property, up from 4.6 percent in 2005. Procedures are also complex, opaque, and inconsistent within and between the provinces. In addition, there are important social concerns arising from poor understanding and awareness of the laws, access to the implementing institutions, and enforcement of property rights, especially among women.

As very little rural land has clear, registered title, use of real estate to secure credit is problematic in Pakistan. The land registries, such as they are, do not register ownership of land, but rather tax obligations based on use. Registration may be evidence of ownership, but it is not universally accepted as proof of ownership. A lender cannot know whether the land being offered as collateral has been given to another person who may have a legitimate claim on the property should the borrower default. Consequently, banks are reluctant to rely on mere registration.

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[50] For prices to remain unchanged from month to month in a market is highly unlikely.

[51] World Bank, 2007. Promoting Rural Growth and Poverty Reduction.

The opacity of the processes of land registration and lack of clear title also lead to a further social issue: significant opportunities for rent-seeking by the people involved in the processes. In most areas of the country, for example, a low-level government revenue official—the *Patwari*—has enormous and exclusive power. The Patwari holds the only land registration records in the jurisdiction, and has exclusive authority to note any changes in the land ownership. The Patwari is also the only official surveyor of the lands within a given jurisdiction, and, as such, determines the boundaries and is the sole arbiter of any boundary disputes. The Patwari's records are all manual, usually carried with the Patwari, and most Patwaris maintain no official office for conducting their duties. The system is opaque, subjective, and subject to abuse.[52]

Public Monopoly on Marketplace Services

Under the colonial era Agricultural Marketing Act—now the Provincial Agricultural Marketing Act—only provincial governments may own and operate regional and district markets. A public agency acquires the land, installs facilities, and puts up buildings to be used by traders. Only traders to whom space has been rented can participate. Not only does this limit the efficient provision of services—the private sector could presumably provide these essential commercial real estate services better than the public sector –it limits the number of traders in rural areas and creates or reinforces monopsonistic power of traders to exploit small farmers who have few alternatives for selling their output.

Price Controls

There are controls or attempts to control prices of both fresh meat and milk at municipal levels. The study group did not learn much about these practices.

Doing Business Indicators

Although not specifically aimed at the rural business environment, annual surveys of the World Bank and IFC compares the business climate among 167 countries. As can be seen in Table 5-6, Pakistan's ranking has fallen markedly in the past three years, from 66 to 77. In many cases Pakistan's fall indicates a stalling of reform while other countries forge ahead, rather than an actual deterioration in the business climate. One area of relative strength—lower tax rates showing up in "Paying Taxes"—may not be sustainable given the fiscal crisis. The survey reflects scores if not hundreds of policies, some of which affect some sectors more than others, that affect growth and investment by private firms, including rural firms and firms that serve rural markets.

[52] USAID. Business Climate Legal and Institutional Reform Diagnostic: 2007, 2008.

Table 5-6
Business Climate in Pakistan

Ranking Category	2006	2007	2008	2009
Ease of Doing Business (overall)	66	74	74	77
Starting a business	44	54	64	77
Dealing with construction permits	93	89	92	93
Employing workers	120	126	134	136
Registering property	57	68	90	97
Getting credit	59	65	51	59
Protecting investors	18	19	19	24
Paying taxes	143	140	148	124
Trading across borders	117	98	67	71
Enforcing contracts	163	163	155	154
Closing a business	34	46	54	53

OTHER ISSUES

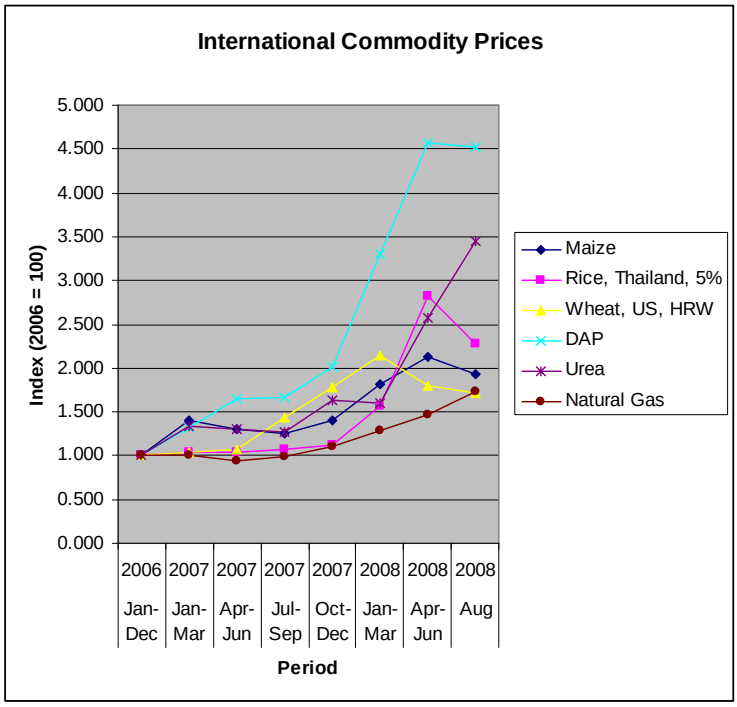
Fertilizer Pricing

Urea, $(NH_2)_2CO$, and DAP (diammonium phosphate) $(NH_4)_2HPO_4$) are the most widely used fertilizers in Pakistan. Their pricing is largely unregulated and both are produced and mixed by private companies. They are freely importable. Natural gas, the primary feed-stock and energy source for the production of urea, is supplied to urea plants at price somewhat below the price of importing gas, so some subsidy is implied and the subsidy may have increased with increases in gas prices internationally.[53] Domestic prices of urea have not increased in tandem with international prices, which have increased much more than food grains, perhaps because of informal government suasion (see Figure 5-4). In 2007-08 shortages developed both because farmers began substituting urea for DAP and also perhaps because of some shipments into Afghanistan. To reduce the shortage, the Government of Pakistan—through the Trading Corporation of Pakistan—imported urea and resold it at a reported loss of $100 million.

The development of a gap between domestic and international prices of urea has led to some of the same problems as with wheat. Even temporary shortages can have a big impact on output if urea is not applied at the right point in the growing cycle. In addition, farmers are encouraged to overuse urea in relation to DAP (which is said to be underused anyway) even more than would have resulted from the sharper rise in DAP prices than urea prices internationally. If fertilizer prices were to be subsidized, it would be preferable to subsidize DAP.

[53] Pakistan imports gas from Iran at a price linked to international market prices, adjusted every three years.

Figure 5-4
International Commodity Prices



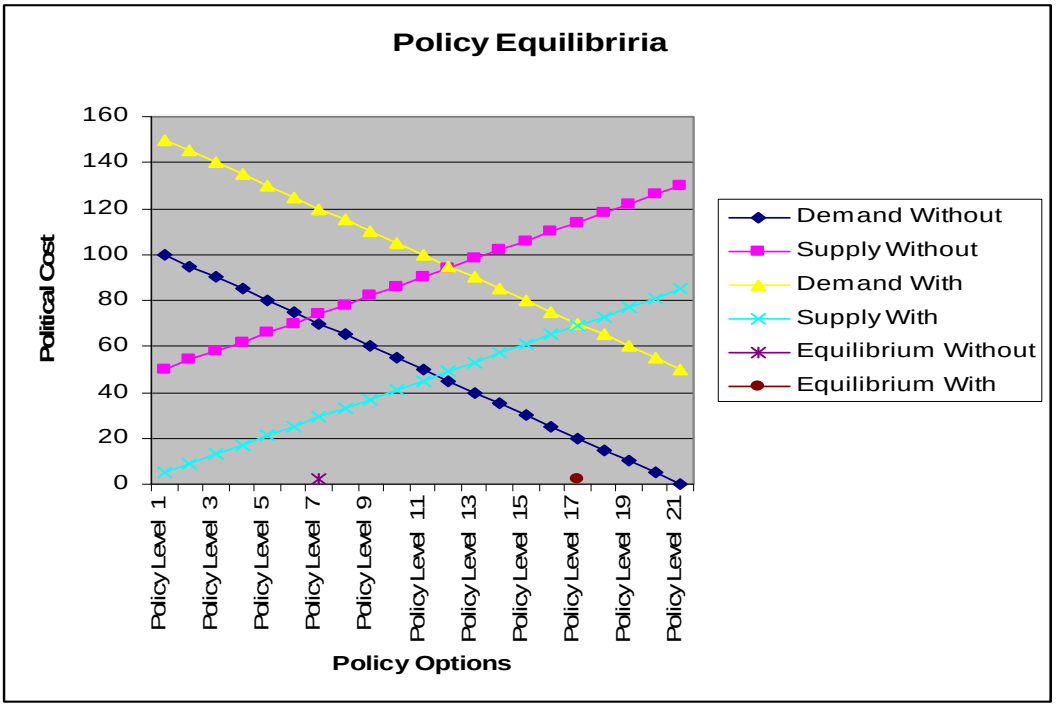
RECOMMENDATIONS

In approaching a program to support policy reform in the food and agriculture sector USAID should assure itself that the Government of Pakistan intends to maintain and wishes to move forward with policies favoring market determination of agricultural products inputs and services. The analysis presented above suggests that this is indeed the direction in which policymakers wish to go, the most egregious missteps of the last two years being attributable to a failure to adjust promptly to drastic and unexpected changes in prices of food and fertilizers. Although USAID should continuously monitor this commitment, it would be unwise to establish specific benchmarks (e.g., procurement price of at least x% of import parity). Rather USAID should maintain a high level dialogue with government in consultation with other donors about the state of agriculture and food policy.

Build Capacity for Policy Reform: Wheat and Flour and Business Climate

We conclude that a significant portion of the policy problems identified here stem from weaknesses in policy options, and the quantifiable merits and demerits of each that technical levels of government are able to explain to political decision makers. Correspondingly, there are weaknesses in the ability of civil society to critique and engage in an evidence-based dialogue about food and agriculture policy. This suggest an “inside-outside” approach in which civil society “demands” better policy while government with USAID assistance “supplies” it. Schematically, both supply and demand for good policy is higher “with” than “without” USAID assistance so the equilibrium level of policy improves from “Policy Level 7” to “Policy Level 17” (Figure 5-5).

Figure 5-5
Policy Equilibria



The problems identified and the need for better policies in not the discovery of this report. An important element in helping move the political economic equilibrium toward better outcomes is to identify who would and would not benefit from reform. This would need to be done in detail and will differ from policy to policy. Exhibit 5-1 presents an initial identification of players in the wheat/flour policy nexus. Two additional points are worth keeping in mind. People may belong in more than one of these groups and which one of possibly conflicting interests they will act on is part of the equation. Second, people may be uncertain where their interests lie.

Programmatic Interventions

What can be done to increase the government's capacity for policy analysis and civil society's demand that the capacity be used to deliver better policies? And how might such an effort fit within broader efforts of USAID to support policy reform in other areas? Basically USAID can finance the following:

- Short- and long-term domestic and foreign consultants;
- Exchange and advanced study programs with U.S. universities, think tanks, and international institutions;
- Data collections and surveys; and
- Publications, websites, and conferences.

Exhibit 5-1
Reform Opponents and Allies

REFORM OPPONENTS

Control Mindset. Although this is not a demographic group, the idea that the economy needs to be planned and controlled by government is a legacy of Pakistan's creation. Not only was Independence attained with support from the British Left, but it came at a point in history when wartime controls were still in full force.

Skeptical Representatives of the Poor. While it is easy enough to show that targeted subsidies to the poor would be better than a quixotic effort to hold flour prices low though the procurement price/issue price system, some of the urban and rural poor *do* benefit and many more may believe that they do. Well meaning representatives of the poor may rightly hold to a "bird in the hand" position until a targeted subsidy system is actually shown to be working.

System Managers. The existing system gives a multitude of public officials discretion in bestowing favors. Who gets subsidized flour? Whose grain is and is not forcibly procured? The opportunities for self-aggrandizement—and graft—are obvious.

Marginal Flour Mills. Because of the way wheat has been allocated in the past, many flour mills exist that have no economic or commercial rationale outside the current system. Given normal risk aversion, even some mills that would benefit from reform may self identify as opponents.[a]

Urban Interests. By definition, an untargeted subsidy reaches some who would be excluded by a better targeted one. Many middle class consumers and employers whose workers benefit, if only marginally, from low flour prices (even if they may loose as taxpayers) can be expected to be less than enthusiastic about reform

"Connected" Traders/Retailers. Some of the rents created by the gap between controlled and market prices and by official procurement distribution are passed on to traders and retailers who are well connected or most skillful in manipulating the system.

REFORM ALLIES

Civil Service Technocrats. The civil service influences and carries out policy made at political levels. It is fortunate that many mid- and upper-level officers understand well the problems created by attempting to hold wheat and flour prices far from international prices. While few would support wholesale reform, many might be happy to "manage" the problem off the policy agenda by moving toward targeted subsidies.

Farmers Groups. Wheat farmers—and this is not a pre-established group, for what farmers plant depends on expected returns—would of course benefit from reform of the procurement price to make it a floor or support price. (That could create problems for the future—witness U.S. and European agricultural policies—but "sufficient unto the day is the evil thereof.")

Large Flour Mills. Even if many will go under, at least some of the larger and better located mills will stand to gain from being able to purchase more wheat and market prices than less wheat at a mix of market and issue price and will recognize this opportunity

Independent Traders/Retailers Along Value Chains. Relatively less well-connected traders and retailers would benefit from reform. Helping them self identify as such would turn them from potential to actual allies.

[a] *For a discussion of the same problem in trade policy, see Hutcheson, Thomas, "Political Economy and Implementation of Trade Policy Reform" (1989) in Vinod Thomas, Best Practices in Trade Policy Reform.*

This assistance can be provided to entities inside and outside government as follows:

Within the federal government, to
- MINFAL's Agricultural Policy Institute,
- Pakistan Planning Commission, and
- Pakistan Institute for Development Economics.

In provincial governments assistance might go to
- Planning and Development departments,
- Food departments, and
- Chief Minister's office.

Outside government, assistance could go to
- University departments of agriculture and agricultural economics for policy research,
- Trade associations, (recognized and ad hoc),
- Think tanks, and
- NGOs working on food and agriculture issues.

The kinds of issues that assistance would be used to address must, of needs, be open ended, but Exhibit 5-2 lists examples.

Strengthen Knowledge Chains

Relevant, timely information and improved plant varieties are not reaching Pakistani farmers as they should. While underfunding of research is a part of the problem, it would be without foundation to believe that more money for research would solve the problem. Whereas this report identifies the problem, it does not have a diagnosis of the causes of the problem. Why and in what ways do the provincial extension programs fail? What keeps knowledge generated by research in private input-supplying firms from reaching farmers? To answer these questions and design a USAID invention to address them USAID should fund an in-depth diagnostic study of the research and extension system, including the role of the private sector. On the basis of that study, USAID should be willing to invest in

- Management audits of research institutes and provincial extension departments.
- Capacity building in research institutes and universities through staff exchanges and PhD programs with U.S. institutions.
- Advanced training for scientific and social science specialties.
- Government-NGO-business partnerships in development and promotion of new seeds, agricultural chemicals, mechanization, cultivation, and water conservation techniques.

Exhibit 5-2

Examples of Assistance to Build Capacity for Reform

• Food subsidy targeting urban *and* rural poor. • Improved data collection and online and electronic media dissemination of agricultural prices and transactions. • Create a land record policy based on digitized cadastral maps and an electronic land titling system easily accessible by farmers and the banking system. • Study women's landholding and inheritance rights • Formulate a policy on minimum economic farm size. • Study and clarify plant breeders rights and the role of public and private sectors in seed development and distribution • Refine fertilizer policies with regard to safety, adulteration, targeting of subsidies • Clarify incentives for adopting water-saving techniques. • Promote safe use of crop protection chemicals without encouraging over use. • Subnational price controls. • CGE modeling of the economy with significant disaggregation of the agricultural sector. • Devise farm and crop model templates for wheat, IRRI rice, Basmati rice, cotton, maize, oilseeds, sugarcane, sugar beet	• Conduct empirical analysis of policy and policy implementation: o Geographical reach of food subsidy programs o Price dispersion geographically and over the crop cycles o Econometric modeling of acreage, input use, and yield responses to input and output price changes o Import and export parity for major crops o Micro credit programs o Flour quota allocation o Effects of local meat, milk price controls o Urea, natural gas feedstock subsidy o Management audits leading to action plans to improve the effectiveness/efficiency of provincial food departments, PAASCO, TCP, provincial seed corporations, etc. o Conduct and publicize subnational "Doing Business/BizCLIR" surveys (with attention to land title, contract enforcement, gender, and access to credit issues) and provide assistance to improve results o Shortages and alleged shortages of agricultural commodities and inputs o Revision of Provincial Agricultural Marketing Acts.

Recreate Capacity for Indus Basin Water Management

Dealing with the Indus Basin—a single, massive, highly complex, interconnected, and changing ecosystem—is an intellectual challenge of the first order. When a dam or barrage is constructed the water and sediment cycles are changed dramatically. When water is diverted onto deserts, the water and salt balances seek new equilibria. In a system so massive and complex, the generation and use of knowledge are becoming even more central to adaptive management. But there has been very little investment in Pakistan in building this knowledge base and the accompanying institutional and human systems. The reverse has happened; even the once-renowned Pakistan

water planning capability has fallen into disrepair. Today there is limited analytical capacity to plan and manage Indus water. Data on rainfall snowmelt and river flow data are inadequate geographically and not available in real time. Data are not tied to National Oceanic and Atmospheric Administration (NOAA) climate and rainfall models and medium term predictions and are not used to feed a systematic hydro-agronomic model of Indus Basin. The country is literally flying blind into a very hazardous future.

USAID has an opportunity to help Pakistan begin to address decades of intellectual disinvestment in Indus system management by

- Building capacity for water management (federal and provincial) by providing consulting services, advanced training abroad in scientific and engineering fields, and exchanges and internships with other large river management systems.
- Developing a hydro-economic model of the Indus Basin linked to agricultural models and global climate change models, fed by remote sensing/satellite data. Such a model is needed for intra-year management, investment planning, and climate change adaptation.
- Developing programs over time to shift land in sugarcane to other crops. This entails crop and economic analysis, designing incentives and disincentives, and devising an information strategy.
- Investing in small-scale hydro/water storage, re-feasibility studies for major works, and remote/satellite sensing of rainfall/water flow/snowmelt/land use.
- Strengthening water policy in areas such as user charges, rights transferability, and water user associations.

As detailed in this report, the problems facing food and agriculture systems in Pakistan are numerous, complex, and interrelated. A common thread affecting all agriculture subsectors is a decline in the capacity of the public sector to make and execute policy, provide incentives, promote an environment conducive to business in rural areas, and undertake investments that enable Pakistani farmers, domestic traders, processors, importers, and exporters to make the best use of Pakistan’s physical and human resources. The rising capacities of the private sector, however, are encouraging:

- More than half of water delivered to fields today comes from largely privately owned tube wells.
- Pakistani and international firms have moved to innovate and supply new seeds, and other agricultural technologies.
- Food processing is growing far faster than either agricultural output or population or income growth.
- Despite problems with policies, Pakistan is poised to be a regional exporter of wheat.

This decline in public sector capacity and rise in private sector capacity suggests the time is ripe for more synergetic relation between the two in Pakistan’s food and agriculture systems. USAID should seek ways to facilitate this new relationship.

6. Conclusions and Recommendations

As detailed in this report, the problems facing food and agriculture systems in Pakistan are numerous, complex, and interrelated. A common thread is a decline in the capacity of the public sector to make and execute policy, provide incentives, promote an environment conducive to rural business, and make investments that enable Pakistani farmers, domestic traders, processors, importers, and exporters to make the best use of Pakistan's physical and human resources. At the same time, private sector capacity is improving. For example,

- More than half of water delivered to fields today comes from largely privately owned tube wells;
- Pakistani and international firms have moved to innovate and supply new seeds, and other agricultural technologies;
- Food processing is growing much faster than agricultural output, population, and income; and
- Pakistan is poised to become a regional exporter of wheat, despite its problematic policies.

The decline of public sector capacity and rise in private sector capacity suggests that a more synergetic relationship between public and private sectors in Pakistan's food and agriculture systems is needed. How can USAID facilitate such a relationship?

USAID ASSISTANCE

In approaching a program to support policy reform in the food and agriculture sector USAID should assure itself that the Government of Pakistan intends to maintain and refine policies favoring market determination of agricultural products inputs and services. The analysis presented in this report suggests that policymakers are indeed committed to such a direction, the most egregious missteps of the last two years being attributable to a failure to adjust promptly to drastic and unexpected changes in prices of food and fertilizers. Although USAID should continuously monitor this commitment, it would be unwise to establish specific benchmarks (e.g., procurement price of at least x% of import parity). Rather USAID should maintain a high level dialogue with government in consultation with other donors about the state of agriculture and food policy. Specific assistance should focus on four broad areas: Indus River Basin water management, agricultural and food value chains, food and agriculture policy and rural business climate reform, and agricultural knowledge chains.

Recreate Capacity for Indus Basin Water Management

USAID has an opportunity to help Pakistan begin to address decades of intellectual disinvestment in Indus system management by

- Raising awareness of the severity and range of water management issues.
- Building capacity for water management (federal and provincial) by providing consulting services, advanced training abroad in scientific and engineering fields, and exchanges and internships with other large river management systems.
- Supporting improved data collection on water use, salinization, and water logging.
- Piloting initiatives for private financing of small-scale irrigation.
- Developing hydro-economic models of the Indus Basin linked to agricultural models and global climate change models and fed by remote sensing/satellite data to enable intra-year management, investment planning, and climate change adaptation.
- Developing programs over time to shift land in sugar cane to other crops (e.g., crop and economic analysis, incentives and disincentives, and information strategy).
- Investing in small-scale hydro/water storage.
- Funding prefeasibility studies for major works, and remote/satellite sensing of rainfall/water flow/snowmelt/land use.
- Strengthening water policy in regard to user charges, rights transferability, and water user associations.
- Developing policies to prevent unsustainable extraction of groundwater.

Strengthen Value Chains

To help strengthen food and agricultural value chains USAID could conduct detailed analyses of

- Obstacles to private sector investments along multiple value chains (e.g., wheat/flour, rice exports, maize/animal feed, oilseed/edible oil, livestock/milk products, livestock/meat processing and export, fruit and nuts/exports).
- Specific cross-cutting issues (e.g., public sector monopoly of rural grain markets, fertilizers and crop protection chemicals, seed development and distribution, grain storage and marketing, food quality and safety standards in domestic and international trade, rural credit markets)

USAID could also support public and private sector infrastructure development on the basis of cost-benefit analysis.

Build Capacity for Reform

Many policy problems identified herein stem from weaknesses in policy options and uncertainties about the quantifiable merits and demerits of each that technical levels of government are able to explain to political decision makers. In addition, civil society has difficulty critiquing or engaging in fact-based discussion about policy. This suggest an “inside-outside” approach in which civil

society "demands" better policy while government with USAID assistance "supplies" it. Achieving progress in policy matters and better policy outcomes requires identifying who would and would not benefit from particular reforms.

What specifically can be done to improve the government's capacity for food, agricultural and rural business climate policy analysis and civil society's demand that that capacity be used to devise better policies? And how might such an effort fit within USAID's broader policy reform work? Basically USAID can finance short- and long-term domestic and foreign consultants; exchange and advanced study programs with U.S. universities, think tanks, and international institutions; data collections and surveys; and publications, websites, and conferences. This assistance can be provided to entities inside and outside government as follows:

Within the federal government, to

- MINFAL's Agricultural Policy Institute,
- Pakistan Planning Commission, and
- Pakistan Institute for Development Economics.

In provincial governments assistance might go to

- Planning and Development departments,
- Food departments, and
- Chief Minister's office.

Outside government, assistance could go to

- University departments of agriculture and agricultural economics for policy research,
- Trade associations, (recognized and ad hoc),
- Think tanks, and
- NGOs working on food and agriculture issues.

For specific forms of assistance see Exhibit 5-2.

Strengthen Knowledge Chains

To strengthen agricultural knowledge chains USAID could fund an in-depth diagnostic study of the public research and extension system that considers how to promote the role of the private sector in providing research and extension services. On the basis of that study, USAID should be willing to invest in management audits of research institutes and provincial extension departments, making extension and research responsive to growers' demands, capacity building in research institutes and universities through staff exchanges and PhD programs with U.S. institutions, and advanced training for scientific and social science specialties. Partnerships between government, businesses, and NGOs could also be explored to develop and promote the use of new seeds, agricultural chemicals, mechanization, cultivation, and water conservation techniques.

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Appendix A. Persons Contacted

The following table lists organizations and persons met during the consultancy. This list may be useful for the Economic Growth Office, USAID Mission, Pakistan, who could add to the listing and even set up a contact database to ease contacts in future assignments. The list is not exhaustive.

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Syngenta Pakistan Ltd.	Mr. Sheikh Moazzum Ahmed	Head Seed Business		Lahore
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Pakistan Agricultural Storage & Supplies Corporation (PASSCO)	Maj.General Anwer Saeed	Managing Director		11- Kashmir Road, Lahore
Rasul Group of Companies, (BAKE PARLOR) www.bakeparlor.com	Mr. Mian Mahmood Hasan	Managing Director	+92 21 5114051, 5114329 info@bakeparlor.com	SC-5 (ST-17), Sector 15, 3rd Floor Suleman Centre, Near Brookes Chowrangi, Korangi, Karachi
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Appendix B. Wheat Data Tables

MINFAL's Latest Wheat Average Cost of Production in Punjab Province for 2007-08 and 2008-09 Crops (PKR values rounded)

Operation / input	2007-2008 Crop					2008-2009 Crop					
	PKR			US$		PKR			US$		%
	Cost / acre	Cost /ha. Conversion	Cost / ha.	FOREX	Total US$	Cost / acre	Cost /ha. Conversion	Cost/ha.	FOREX	Total US$	
LAND PREPARATION											
Rotavator / disc plough	330	2.47	815	76	11	435	2.47	1,074	76	14	
Ploughing	480	2.47	1,186	76	16	640	2.47	1,581	76	21	
Ploughing & planking	195	2.47	482	76	6	260	2.47	642	76	8	
Planking	72	2.47	178	76	2	97	2.47	240	76	3	
Leveling	137	2.47	338	76	4	180	2.47	445	76	6	
Sub-total:	1,214	2.47	2,999	76	39	1,612	2.47	3,982	76	52	8
SEED & SOWING		2.47	-	76	-		2.47	-	76	-	
Seed	1,105	2.47	2,729	76	36	1,580	2.47	3,903	76	51	
Tractor - drilling	37	2.47	91	76	1	50	2.47	124	76	2	
Labor for broadcasting	15	2.47	37	76	0	22	2.47	54	76	1	
Ploughing if broadcasting	315	2.47	778	76	10	415	2.47	1,025	76	13	
Planking if broadcasting	35	2.47	86	76	1	50	2.47	124	76	2	
Sub-total:	1,507	2.47	3,722	76	49	2,117	2.47	5,229	76	69	11
BUND MAKING		2.47	-	76	-		2.47	-	76	-	
Manual	18	2.47	44	76	1	25	2.47	62	76	1	
Tractor	56	2.47	138	76	2	75	2.47	185	76	2	
Sub-total:	74	2.47	183	76	2	100	2.47	247	76	3	1
HERBICIDES		2.47	-	76	-		2.47	-	76	-	
Sub-total:	315	2.47	778	76	10	335	2.47	827	76	11	2
IRRIGATION		2.47	-	76	-		2.47	-	76	-	

Operation / input	2007-2008 Crop					2008-2009 Crop					
	PKR			US$		PKR			US$		%
	Cost / acre	Cost /ha. Conversion	Cost / ha.	FOREX	Total US$	Cost / acre	Cost /ha. Conversion	Cost/ha.	FOREX	Total US$	
Canal	50	2.47	124	76	2	50	2.47	124	76	2	
Private tube well	1,515	2.47	3,742	76	49	1,650	2.47	4,076	76	54	
Mixed	78	2.47	193	76	3	85	2.47	210	76	3	
Sub-total:	1,643	2.47	4,058	76	53	1,785	2.47	4,409	76	58	9
LABOR FOR IRRIGATION, WATER COURSE CLEANING		2.47	-	76	-		2.47	-	76	-	
For irrigation	160	2.47	395	76	5	245	2.47	605	76	8	
For water course cleaning	45	2.47	111	76	1	65	2.47	161	76	2	
Sub-total:	205	2.47	506	76	7	310	2.47	766	76	10	2
FARM YARD MANURE		2.47	-	76	-		2.47	-	76	-	
Sub-total:	90	2.47	222	76	3	120	2.47	296	76	4	1
FERTILIZER		2.47	-	76	-		2.47	-	76	-	
DAP	1,315	2.47	3,248	76	43	3,345	2.47	8,262	76	109	
Urea	918	2.47	2,267	76	30	1,215	2.47	3,001	76	39	
SSP	50	2.47	124	76	2	110	2.47	272	76	4	
NP	63	2.47	156	76	2	160	2.47	395	76	5	
CAN	15	2.47	37	76	0	25	2.47	62	76	1	
SOP	25	2.47	62	76	1	55	2.47	136	76	2	
Gypsum	2	2.47	5	76	0	2	2.47	5	76	0	
Transport & application	63	2.47	156	76	2	80	2.47	198	76	3	
Sub-total:	2,451	2.47	6,054	76	80	4,992	2.47	12,330	76	162	26
HARVESTING		2.47	-	76	-		2.47	-	76	-	
Sub-total:	1,275	2.47	3,149	76	41	1,910	2.47	4,718	76	62	10
THRESHING		2.47	-	76	-		2.47	-	76	-	

Operation / input	2007-2008 Crop					2008-2009 Crop					
	PKR			US$		PKR			US$		%
	Cost / acre	Cost /ha. Conversion	Cost / ha.	FOREX	Total US$	Cost / acre	Cost /ha. Conversion	Cost/ha.	FOREX	Total US$	
Threshing	950	2.47	2,347	76	31	1,425	2.47	3,520	76	46	
Man days	235	2.47	580	76	8	360	2.47	889	76	12	
Sub-total:	1,185	2.47	2,927	76	39	1,785	2.47	4,409	76	58	9
LAND RENTAL		2.47	-	76	-		2.47	-	76	-	
Land rental	2,670	2.47	6,595	76	87	4,000	2.47	9,880	76	130	
Land tax	66	2.47	163	76	2	66	2.47	163	76	2	
Management charges	375	2.47	926	76	12	425	2.47	1,050	76	14	
Sub-total:	441	2.47	7,684	76	101	4,491	2.47	11,093	76	146	23
TOTAL COST	10,400	2.47	25,688	76	338	19,557	2.47	48,306	76	636	
Yield											
Kg / acre					1,108					1,108	
Kg / ha.					2,737					2,737	

Note Many costs / expense items are combined, warranting need for more detailed analysis for each crop production category. There is no separation for irrigated or barani wheat production

SOURCE MINFAL, Agriculture Policy Institute, Islamabad. September 2008.

Wheat Cost of Production, Average Farmer Gross Margin, 2007-2008 Season (provisional)

Expense Item	Per Acre		Per Hectare				Gross Margin Cost Allocations (%)
	Expenses %	Costs PKR	Cost/ha.	PKR/ha.	Forex	US$	
Seed value: 50 kg	10	900	2.47	2,223	76	29	11
Land preparation	8	700	2.47	1,729	76	23	8
Fertilizer	36	3,030	2.47	7,484	76	98	36
Essentially, 100 % in-organic fertilizer, locally & imported							
Rate for medium soils: DAP 1.5 bag, Urea 2 bags, of 50 kg each							
Fertilizer prices are increasing & the input is in short supply							
Wholesale & retail dealers adulterate fertilizer, reducing efficacy							
Agricultural chemicals	9	750	2.47	1,853	76	24	9
Pesticides, Weedicides (herbicides)							
Irrigation: Partially canal water, rest thru tube wells	15	1,250	2.47	3,088	76	41	15
Harvesting	14	1,200	2.47	2,964	76	39	14
70 % hand harvest by sickle							
30% done by combine harvesters							
Other costs include fixed labor and taxes	8	700	2.47	1,729	76	23	8
Cost per acre		8,530	2.47	21,069	76	277	100
Yield. Tonne/acre	1.2						
Tonnes/ha.	2.964						
On farm price. PKR 15,625 / tonne			2.47	-	76	-	
Gross income		15,625	2.47	38,594	76	508	
Less total costs						277	
Gross margin profit (loss)						231	

NOTES: Cropping is last week of Oct to end Nov direct seeding manually or seed drill; harvest begins in April lasts 150 days. Seed source is Punjab Seed Corporation. Land preparation equipment is disc plough, cultivator, heavy wooden plank for breaking mud clumps. Fertilizer is imported and local. Plant protection products from local and multinational companies-mostly herbicides. Irrigation water costs approx. Rs.1250/ acre | Harvesting by hand incl. rates for male & female; rented combines Rs. 1200/acre. Other costs incl. fixed labor for fertigation, chemical application, crop management. Crop commodity sold on the basis of On Farm, purchased by middle man for sale to Food Dept. Crop commodity QA verification at time of sale to buyer: No strict quality verification. Payment 30 days in cash/cheque—mostly cash. Conversion, imperial to metric units. Costs/ha. 1.0 acre X 2.47 = 1.0 ha.