PAKISTAN FOOD AND AGRICULTURE PROJECT

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ABBREVIATIONS AND ACRONYMS

ABAD	Agency for *Barani* Area Development
ADB	Asian Development Bank
APRI	Agricultural Policy Research Institute
AWB	Area Water Board
CELDAC	Community Empowerment through Livestock Development and Credit
CGIAR	Consultative Group on International Agricultural Research
COP	Chief of Party
DIFD	UK Department for International Development
FAO	Food and Agriculture Organization
FATA	Federally Administered Tribal Areas
GDP	Gross Domestic Product
GOP	Government of Pakistan
IRR	Internal Rate of Return
LUMS	Lahore School of Management Sciences
MINFAL	Ministry of Food, Agriculture and Livestock
NARC	National Agricultural Research Center
NGO	Non Government Organization
NRSP	National Rural Support Program
NWFP	North West Frontier Province
PARC	Pakistan Agricultural Research Council
PDCC	Pakistan Dairy Development Company
PEAR	Pakistan Economic and Agricultural Reform
PIDA	Punjab Irrigation Development Authority
PID	Punjab Irrigation Department
PIDE	Punjab Institute of Development Economics
PRSP	Punjab Rural Support Program
RFA	Request for Applications
RFP	Request for Proposals
RSP	Rural Support Program
RSPN	Rural Support Program Network
TFHF&C	Task Force for Horticulture Finance and Competitiveness
USDA	United States Department of Agriculture
UNDP	United Nations Development Program
USAID	United States Agency for International Development
WUA	Water User Association

CHAPTER 1: INTRODUCTION

1.1. Background

In April 2008, Washington identified Pakistan as a "Global Food Initiative" priority country needing assistance in addressing its food security situation. It is expected that such assistance will play an important role in enhancing stability in Pakistan and within the region. In the following months, USAID/Pakistan initiated an effort to design a food and agriculture project in response to this initiative. An initial concept paper was prepared as a first step in the project design effort. The present paper expands that initial step into a more detailed project description.

Pakistan is characterized by a high degree of income inequality and geographic disparities, two major sources of potential destabilization. Those divisions are particularly pronounced in the rural areas, where most of the rural poor lack access to land, irrigation water and other factors of production. Reducing poverty and income inequality will require revitalization of the rural economy.

A more vibrant rural economy will depend on Pakistan's effort to stimulate the agricultural sector. Agricultural development will not only raise farm income and generate on-farm employment but, more importantly, it will promote expansion of the rural non-agricultural sector, which will have beneficial effects on rural poverty and social stability.

1.2. Objectives

Promoting efficient and sustainable agricultural growth is a necessary condition for rural growth, employment generation, poverty reduction and social stability. Moving forward, it is imperative to maintain a comprehensive, multifaceted approach to agricultural development and to ensure that sufficient resources are invested in the undertaking. Yet to be successful, the agricultural development effort should be strategic, highly focused and integrated. In that context, the design team focused on achieving a large aggregate impact on Pakistan's agriculture, and on the institutional development needed to achieve that impact.

This paper provides a rigorous conceptual framework and a set of strategic interventions to achieve efficient and sustainable agricultural growth under the proposed Pakistan Food and Agriculture Project. Proposed project activities derive from a strategic analysis of the agricultural sector in Pakistan and a prioritized set of highly-focused, integrated interventions. These interventions are designed to achieve steady, sustainable growth in the agricultural sector; raise income for small farmers; and increase employment opportunities in rural areas.

1.3. Methodology

Field work for this paper was conducted in October-November 2008 in Pakistan over a four-week period by a project design team consisting of Bechir Rassas, team leader; John Mellor, senior economist; Kenneth Choquette, irrigation specialist; Yohannes

Gebremedhen, land tenure expert; and Maliha Hamid Hussein, Pakistani economist. Field work was conducted in Islamabad, Lahore, Faisalabad, Karachi, Hyderabad, and Peshawar.

During this period, the design team reviewed existing documents, and conducted extensive interviews and consultations with government officials at the national and provincial levels, representatives of bilateral and multilateral donors, non-government organizations, and private sector concerns. (A list of people consulted is provided as an annex to this paper.) Interviews were supplemented with a high-level roundtable discussion with a distinguished group of 15 prominent Pakistani agricultural sector officials, scientists, economists, academics and opinion-makers.

A presentation of the preliminary results was made to representatives from the public and private organizations, NGOs and bilateral and multilateral organizations consulted for the project design work. Two separate presentations of preliminary results were also made to USAID personnel, including the Mission director. Comments made during the three presentations were incorporated in this paper.

It is important to re-emphasize that the analysis and recommendations presented here were developed with extensive input — in both group and individual discussions — from the most experienced and knowledgeable Pakistani and International experts. In essence, our conclusions and recommendations reflect a consensus derived from those broad consultations and wide-ranging discussions.

The paper is divided into four chapters. Following this introductory material, Chapter 2 presents a detailed conceptual framework for the design effort. Chapter 3 describes strategic interventions that would create the conditions for accelerated growth in the agricultural sector in Pakistan. Major activities, expected benefits and the local institutional context are outlined for each key intervention. Chapter 4 proposes a project management structure. Conclusions and recommendations are presented in Chapter 5.

CHAPTER 2: CONCEPTUAL FRAMEWORK

2.1. Agriculture in Pakistan: Current Status and Targeted Future Growth Rate

Agricultural growth in Pakistan has been well below potential over the past several years despite an unusually favorable set of physical resources, including vast irrigated areas. In consequence, rural incomes are growing little, if at all, and poverty reduction has virtually halted.

The project interventions proposed in this paper concentrate on key agricultural subsectors that comprise the bulk of the overall agricultural economy. The objective of those interventions is to accelerate growth in the targeted subsectors with a view to achieving a 5 percent overall growth rate in the agricultural gross domestic product (GDP).[1] Through employment multipliers to the rural non-farm sector, that rapid acceleration in growth would lead to a rapid increase in employment and a decline in poverty.

The agricultural GDP growth rate in Pakistan was only 1.5 percent in 2007, significantly lower than the population growth rate (Pakistan National Income Statistics 2008). This very low rate was due to temporary factors, including unfavorable weather conditions. The 1989-90 to 2004-05 average growth rate was 2.3 percent (Pakistan National Income Statistics 2007). Immediately following that period, the growth rate was about 3 percent — a rate that can be expected from smallholder-induced improvements in cultivation practices, growth in the rural labor force, and small changes in cropping intensity (FAOSTAT). Thus, we have selected this rate as a base for the 2 percent increment because it is more representative than that achieved in 2007 and because it is more in line with growth rates in countries with similar characteristics in terms of rural labor force, cropping intensity and related agricultural practices.

The 3 percent target used is reasonable relative to Pakistan's resource base and demand structure as well as by international comparisons. Pakistan has the resource base for achieving a 5 percent growth rate, 2 percent higher than the base rate. Agricultural GDP growth rates in fast-growth middle-income countries average 4 to 6 percent (Mellor 1992). Pakistan has unusually favorable climate and irrigation assets, which compare favorably with those found in the best-endowed areas in India. However, current yields in Pakistan are well below yields achieved in those areas (World Bank 2007).

It is worth noting that Pakistan achieved nearly a 5 percent growth rate over a ten-year period in the 1960s (World Bank 1987). The per capita growth rate in the 1960s was 4.4 times higher than the current rate. Thus, the proposed 5 percent agricultural growth rate seems a reasonable target by international comparisons as well as from the viewpoint of Pakistan's own resource base and demand structure. The incremental two percent growth rate is achievable because the weight of the potential fast-growth components — livestock

[1] Agricultural GDP is a measure of the total flow of goods and services produced by the agricultural economy over a specified time period, normally a year or a quarter. It is obtained by valuing outputs of goods and services at market prices, and then aggregating.

and horticulture — is much larger in Pakistan today than in the earlier decades, and the current growth in demand in the domestic and international markets is much more significant.

2.2. Selection of Priority Commodity Sets

Much of what the public and private sectors do to accelerate agricultural growth is commodity specific. This is markedly true of applied research, the technical aspects of extension, and a high proportion of private sector marketing. This paper is organized largely around commodity sets, selecting those that are potentially the largest contributors to a high growth rate.

The importance of specific commodity sets to future growth is a function of their agricultural GDP base weight and the growth rate that can be achieved. It follows that focusing on commodities with only a small base achieves little short-run impact on aggregate growth even if its rate of growth is high. Similarly, if the growth for a given commodity is constrained — for example by shortage of land — then that commodity can be important to growth only if the base weight is very high.

Table 2.1 presents the base weights for eight commodity sets. It also estimates growth rates based on observation of what is actually achieved in high growth-rate strategies (Mellor 1992), which in turn are related to production and market potentials. High growth rates are more easily achieved for commodities with high value relative to the area under cultivation. Area under cultivation can increase, and elastic demand growth[2] can support rapidly expanding markets.

Based on Table 2.1, we propose interventions that focus on three commodity sets representing nearly three-quarters of future growth in a strategy to achieve an overall growth rate of five percent. These are dairy (livestock), wheat and horticulture.

[2] See definition of demand elasticity below.

Table 2.1: Commodity Composition, 5 Percent Growth Rate

Commodity	Base (% agricultural GDP)	Growth Rate (%)	Incremental Growth (%)
Livestock	**47**	**6**	**57**
Wheat	**14**	**3**	**9**
Horticulture	**5**	**8**	**8**
Cotton	10	4	8
Rice	6	4	5
Sugarcane	4	3	3
Miscellaneous	11	4	9
Forestry	3	2	1
Total	100	5	100

Note: Incremental growth for each commodity is calculated by multiplying each commodity's share of agricultural GDP (column 2) by its corresponding growth rate (column 4), and dividing by total growth rate (last row, column 3).

Source: Pakistan Economic Survey 2005-2006; design team calculations.

Dairy

As apparent in Table 2.1, livestock dominates incremental growth potential (column 4) because of its large base weight (column 2) and its potential for rapid growth (column 3) due to high income elasticity of demand[3] and the relative lack of constraints from the cropped area[4].

The large size of the dairy sector in Pakistan's agricultural and national economy was a key factor in its selection. Livestock accounts for 52 percent of agricultural GDP. Dairy, meaning milk and the associated meat production, dominates livestock production, accounting for about 40 percent of total agricultural GDP.

Demand growth for dairy products — in the context of slow income growth — is estimated by Nestlé Pakistan at 5.5 percent per year (private communication). Demand studies for South Asia consistently show income elasticity of demand around 1.5 (that is, a 10

[3] Income elasticity of demand is the proportionate change in the quantity of a commodity demanded after a given change in the income of consumers with prices held constant. For instance, an income elasticity of demand of 1.5 indicates that a 10 percent increase in income will result in a 15 percent increase in the quantity demanded with prices held constant. If an income elasticity has an absolute magnitude larger than 1, the quantity demanded of a given commodity is said to be income elastic, indicating that — holding prices constant — if income increases total expenditure on the commodity will increase.

[4] The dairy sector is little constrained by land availability so that the production growth rate is not constrained on that account. High-quality fodder area can be increased greatly and concentrate feed can be imported if domestic production falls short, as is the case for China.

percent increase in income results in a 15 percent increase in consumption). Given low per capita consumption in Pakistan relative to high-income countries, it is clear that there is scope for demand growth in the dairy sector. India, a neighboring country, is experiencing very rapid growth in demand for dairy products and, as would be the case for Pakistan, much of that growth is for sweets and various types of cheese not common in the United States.

The structure of the dairy sector in Pakistan indicates that most of the benefits from project interventions are likely to accrue to the most vulnerable segments of the population, particularly women. Since livestock ownership is more evenly spread across rural households than is land ownership or even access to land, productivity gains in this subsector are likely to be more pro-poor than productivity gains in major crops such as wheat, rice, maize and cotton.

Dairy production is dominated by low-income households, with the typical farm having only one or two milking animals, with the size of landholding below the national average, and with many landless families keeping dairy animals. Dairy production is also dominated by women, thus offering immense opportunity to improve their status by supplying services such as extension and practical veterinary services (as demonstrated on a significant scale by the UNDP-supported Nestlé/Engro project). There is also scope for women to expand from production to marketing and control of proceeds; this is prevalent in neighboring states of India and occasionally happens in Pakistan at present.

Thus, dairy development is an important pro-poor undertaking. A high growth rate in Pakistan agriculture is not possible without rapid growth in the dairy sector. As previously noted, the ultimate objective of the project is to increase the overall agricultural growth rate by two percentage points from about 3 percent to about 5 percent. Multiplying the dairy sector's high growth rate by its large base shows that about one-third of the 5 percent target growth rate will be generated by this sector.

Another advantage of including dairy into this project is that the U.S. has comparative advantage in providing technical assistance in this area because of its own experience, both at home and in many developing countries under USAID-funded projects.

Wheat

Wheat was selected as a targeted commodity for several reasons. First, in a fast growth strategy, with 14 percent of incremental growth in agricultural GDP, wheat is second in importance after livestock, just ahead of horticulture (see Table 2.1). Second, Pakistan has comparative advantage in wheat production at import parity prices (World Bank 2007). Third, current yields in Pakistan are low relative to comparable areas in the Indian Punjab (World Bank 2007). For this reason, wheat represents an excellent candidate for a straightforward applied research and extension push, for which returns would be high relative to expenditure. Fourth, wheat is an important commodity in the diet of those below the poverty line, and more generally it represents a critical commodity in terms of its contribution to national food security. Fifth, due to its importance in food security, wheat is a central component of the complex food and agricultural policy debate to which USAID contributions will be invaluable.

Horticulture

We also recommend horticulture because it ranks third overall (behind livestock and wheat) in the estimated contribution to the target 5 percent growth rate (see Table 2.1).

This is possible despite a low base of about 5 percent of agricultural GDP because of a targeted high growth rate of 8 percent per year[5].

A second reason for including horticulture relates to USAID's comparative advantage in this sector through its worldwide project experience in promoting production and marketing of high-value crops. The U.S. is, of course, a world leader in horticulture production.

Within horticulture, we specifically recommend commodity-oriented projects for citrus, mango, potato and onion — four commodities that account for well over half of all horticultural production (see Table 2.2) — plus a small horticultural set of special importance in the border areas, such as apples and olives. High income elasticity of domestic demand, together with promising export markets provide the basis for a very high growth potential.

Although we have limited our recommendation to three commodity sets (dairy, horticulture and wheat), this is not to say that other sectors are not worthy of attention. However, including other commodity groups such as cotton and rice may not be compatible with the U.S. policy context and/or would make only modest contributions to the 5 percent aggregate growth target. Because dairy, horticulture and wheat already account for about two-thirds of incremental growth, including secondary crops would also spread program resources too thinly and divert attention away from the highly strategic focus of the project.

[5] The 8 percent growth rate is driven, on the demand side, by a growth of 6 percent per year in the domestic market (calculations based on 2 percent population growth, 3 percent per capita income growth and an income elasticity of demand of 1.33 [FAOSTAT]). Added to that is the assumption that one-fourth of incremental production could be exported. (Given that there is already strong effort for exports of citrus and mango, and potential — in the Middle East — for potato and onions, this assumption seems reasonable.) There are variants on this assumption. For instance, since citrus and mango already have a relatively strong export market, exporting 40 percent of the increment seems possible — giving a 10 percent growth rate for those two, instead of the 8 percent for the two annual crops.

On the supply side, the major reason agriculture has difficulty exceeding the 5 percent growth rate is the land constraint. The land constraint is binding on crops, such as wheat, that already occupy a large proportion of the area cultivated. For the horticultural crops, area cultivated is very small, so much of the expansion could come from area expansion, particularly that a small decrease in field crops translates into a large expansion of the high-value crops. There is also large scope for increased yields and quality improvement. Already highly developed, the industry for supplying seedlings and seeds in Pakistan has shown a high degree of flexibility. The program needs to ensure that area expansion occurs with appropriate credit and technical support to the private sector. Thus, the supply constraint is more on the side of applied research and extension.

Table 2.2: Horticultural Crops in Pakistan
(crop as a percentage of total production)

Crop	Total Fruits	Total Vegetables	Total Horticulture
Citrus	**29**		**14**
Mango	**25**		**12**
Dates	9		5
Banana	2		1
Apple	5		3
Other	28		14
Subtotal (citrus, mango)	**54**		**26**
Potato		**30**	**15**
Onion		**26**	**13**
Other		45	23
Subtotal (potato, onion)		**56**	**28**

Source: Design team calculations using data from Pakistan Agricultural Statistics, 2004-2005

Cotton is the only other commodity with a major share in agricultural GDP (third, after wheat, with a ten percent of agricultural GDP). It is also an important export commodity with ready potential for yield increases. However, cotton was not included because, as a major exporter of cotton, Pakistan may not fit into U.S. priorities for assistance. In addition, the largest constraint to growth in cotton production in Pakistan is the failure to use Bt cotton[6] due to intellectual property rights issues (some illegal Bt cotton is planted). Monsanto[7] is trying to work out an arrangement for Sindh without national legislation. It is important to note that support to biotechnology research will inevitably build advocacy for intellectual property rights, with positive implications on Bt cotton production and other biotechnology initiatives.

[6] *Bacillus thuringiensis* (*Bt*) is a bacterium that produces crystals protein, which are toxic to many species of insects. Since 1996 plants have been modified with short sequences of genes from *Bt* to express the crystal protein *Bt* makes. With this method, plants themselves can produce the proteins and protect themselves from insects without any external *Bt* and/or synthetic pesticide sprays.

[7] Monsanto is a U.S. agricultural technology company dealing with seed, crop protection, biotechnology, and animal agriculture. It has strategic platforms in high-value, large- and small-scale crops, specifically soybeans, cotton, corn and vegetables.

Rice would add greatly to the complexity of the project, with a very modest impact on growth. (As shown in the table above, rice has less than half the share of agricultural GDP as wheat.) In addition, Pakistan is a major exporter of rice and U.S agricultural interests may not favor such interventions.

Other commodities, such as sugarcane, oilseeds, minor cereals and minor horticultural crops have a small contribution potential to aggregate agricultural growth because of their small base and/or modest growth-rate potentials.

While the three recommended commodity sets encompass three-quarters of agricultural output growth in a fast-growth strategy (see Table 2.1), the 5 percent growth rate target cannot be achieved without concurrent rapid growth rates in the subsectors not targeted by USAID. However, the USAID initiative is likely to have a multiplier effect. Combined with analysis provided by the agricultural policy research institute, the proposed large-scale USAID effort in dairy, horticulture and wheat would provide a powerful demonstration effect, with a significant impact on the rest of the agricultural sector.

2.3. The Employment Impact of Agricultural Growth

Employment growth and poverty reduction are two sides of the same coin. The poor are largely laborers. In general, the rural poor earn more from off-farm employment than from their own land.[8] If employment grows more rapidly than labor-force growth, the poor increase their annual employment — and wage rates often rise as well.

In Pakistan two-thirds of the total population are rural, as are more than two-thirds of the poor (World Bank 2002). Counting as farmers only those with enough land to provide half the poverty level of income, only half the rural population are farmers.[9] The other half are rural non-farm. The rural non-farm population, among which poverty is concentrated, produces non-tradable goods and services, meaning goods for which the only market is local. Farmers spend half their incremental income on the rural non-farm sector (Bell and Hazell 1982, Hazell and Ramaswamy 1991, Mellor 1992, Mellor 1976). Thus, a rise in farm income drives demand for the large, employment-intensive, non-tradable, rural non-farm sector.[10] Large absentee landowners, so common in the Sindh, have very different consumption patterns (Mellor 1992). Their consumption expenditures have high capital intensity and large import content. Raising their incomes does little to reduce rural poverty.

These relationships explain the close statistical tie between growth in agriculture and poverty reduction.[11] The association between agricultural growth and lower poverty rates

[8] There is a rich empirically-based body of literature on this topic, including Barrios and Mellor 2006 in Guatemala, Fan et al. 2002 in China, Bhalla 2004 in India, Mellor and Gavian 1999 in Egypt, Mellor and Usman 2006 in Afghanistan, and Haddad and Ahmed 1999 in Egypt.

[9] These data are developed from size distribution of farm data in the National Census of Agriculture, 2005. The results are similar to exercises in Mellor and Barrios 2006 for Guatemala; various studies for Egypt, including Mellor and Gavian 1999; Mellor and Usman 2006 for Afghanistan; and Haddad and Ahmed 1999 for Egypt.

[10] These relationships are developed in a mathematical form in Mellor and Ranade, Pakistan Development Review 2007; the logic is spelled out in non-mathematical terms and the various coefficients analyzed empirically in Mellor 1976. The earliest development of this relationship is stated in Johnston and Mellor 1961. A full exploration and empirical analysis appears in Haggblade et al. forthcoming.

[11] Ravallion and Datt 2002 provide a major cross section analysis of Indian data showing no relation between manufacturing growth and poverty reduction and a very strong relation between agricultural growth and poverty reduction. Ravallion and his colleagues repeat those analyses for several other countries; Timmer 1997 carries out a more sophisticated analysis

is primarily due to growth in income (and production) by farmers, who then spend much of their increased income in the rural non-farm sector.

In the 1960s, agriculture in Pakistan grew rapidly and poverty declined rapidly. In the 1970s, agriculture grew slowly and poverty reduction slowed. In the 1980s, agriculture once again grew rapidly and poverty declined from 49 percent to 36 percent of the population. In the slow agricultural growth period between 1989-90 and 2004-05 no change in poverty occurred (World Bank 2007). A large number of international cross-section studies confirm this relationship.[12]

With the help of a few assumptions, these relations can be converted into sectoral employment impact for Pakistan. Acceleration in the agricultural growth rate has an immense effect on employment despite the increased labor efficiency in agricultural production because of (1) the large size of the rural non-farm sector; (2) the rural population's high elasticity of demand for output from the rural non-farm sector; and (3) the sector's labor intensity. It is these factors that provide the results seen in the international cross-section data and in the relationships over time in Pakistan.

A common assumption in Pakistan is that the labor force grows at about two million per year. The data in Table 2.3 suggest that with the 5 percent agricultural growth rate (and 8 percent in the urban sector) jobs creation is about 50 percent larger than labor force growth.[13] That extra job creation allows underemployed labor to be absorbed or real wages to rise — in practice it is a combination of both.

These results generate a rapid decrease in poverty. It is critical to note here that the 3 percent agricultural growth rate approximately matches the labor force growth rate and hence provides no decline in poverty. Since it is the agricultural growth in excess of the labor force growth that has a positive impact on poverty reduction, achieving the additional 2 percent growth in agriculture in Pakistan as postulated in this paper should be viewed as a vital component of the county's poverty reduction strategy and USAID's contribution to its implementation.

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with similar results, which he expands upon for Asia in Timer 2005; Thirtle 2001 carried out for DIFD a similar analysis with similar results.

[12] The earliest empirical studies on this issue was Ahluwalia 1978, in which it was shown that over time the cyclical fluctuations in weather in India resulted in large decreases in poverty in years of good weather and hence large agricultural production — and conversely in poor weather and low agricultural-production years. A highly sophisticated follow-up by Dharam Narain was reported in Mellor and Desai 1985. Timmer 1997 conducted one of the earliest of the international cross-section studies, where he found that agricultural growth had a large impact on poverty decline and industrial growth very little. He also found that agricultural growth had little impact on poverty reduction when land distribution was highly tilted towards very large landowners as is commonly the case in Latin America. Thirtle 2001 confirmed these results in an independent study for the U.K. Department for International Development (DFID). Martin Ravaillon and colleagues at the World Bank carried out several such studies, of which Ravaillon and Datt 2002 is the most revealing. Using detailed data from India, this study found no impact of industrial growth on poverty reduction. A more recent study in Africa (Badiane 2008) concludes that "for the foreseeable future and in the large majority of African countries, agriculture will remain the most important sector in the battle to reduce poverty." The study shows that among countries that have experienced long periods of steady agricultural growth, such as Ghana, Mozambique and Uganda, the rate of poverty has fallen significantly. In the case of Ghana, for instance, the poverty headcount fell from 52 to 28 percent between 1992 and 2006, and in Uganda from 56 to 31 percent.

[13] This is consistent with achievements in the high-growth agricultural countries discussed in Mellor 1992.

Table 2.3: GDP & Employment Growth Rates

Sector	Employment Base %	GDP Base %	Growth Rate GDP 5% (3%)	Elasticity Employment	Growth Rate Employment
Farm	32.4	20	5 (3)	0.3	1.5 (0.9)
RNF	35.1	24	6.25 (3.25)	0.9	5.6 (2.9)
Subtotal	**67.5**	**44**			
Urban	32.5	56	8	0.5	4
Total	**100**	**100**	**7 (5.9)**		**3.75 (2.6)**

Notes:

(1) Figures in columns 2 and 3 (calculated using data from World Bank 2002) show the proportion of national employment and GDP in the two rural sectors — farm and rural non-farm — and the urban sector.

(2) The fourth column shows a single growth rate for the urban sector of 8 percent (purposely assumed at the level associated with rapid overall growth, but considerably higher than in Pakistan at present) and for agricultural (farm) production alternatives of 5 percent and 3 percent (corresponding figures under the 3 percent scenario are in parenthesis). The growth rate for the rural non-farm sector is derived from the agricultural growth rate by (a) assuming an expenditure elasticity in the rural non-farm sector of 1.5 (see Bouis 1999 for farm-survey support, the Indian National Expenditure Studies and others); (b) applying that parameter to the per capita rate of agricultural growth (a proxy for income); and then (c) adding the population growth back.

(3) The elasticity of employment with respect to output growth is taken from field studies at a low 0.3 for agriculture (Rao 1975), reflecting the increased labor productivity associated with yield-increasing innovation. At 0.5, the elasticity for the urban sector is higher (despite the frequency of no employment increase in large-scale industry with growth in output — e.g., Indonesia in recent years). The 0.5 is a weighted average of 0.3 for the large-scale sector and 0.9 for the informal sector. The 0.9 coefficient for the rural non-farm sector reflects the fact that production increases in response to increased demand from farmers, not from reduced costs (Gavian et. al.2002.)

Table 2.4 converts the data in Table 2.3 into shares of employment and GDP generated by that sector. Under a rapid agricultural growth scenario, 3.5 times as much employment is generated by agriculture and its multipliers in the rural non-farm sector as in the urban sector. Note however, that nearly twice as much of GDP growth is generated in the urban sector. Thus, if the objective is simply to generate GDP, the urban sector is far more efficient than the rural sector. The situation is reversed if poverty reduction and higher employment are the two major considerations.

Not surprisingly, under the slow growth scenario the urban sector generates three times as much GDP as the rural sector. However, the rural sector generates about the same share of employment growth as the urban sector. It is important to note, however, that poverty cannot be adequately reduced under the slow agricultural-growth scenario.

Table 2.4. Employment & GDP Growth under 5% and 3% Agricultural Growth (by Sector)

Sector	Share Employment Growth (5%)	Share Employment Growth (3%)	Share GDP Growth (5%)	Share GDP Growth (3%)
Farm	13	11	14	10
Rural Non-Farm	65	39	22	13
Subtotal	***78***	***50***	***35***	***24***
Urban	22	50	64	77
Total	**100**	**100**	**100**	**100**

Note: Derived from Table 2.3 by applying the growth rates for employment and GDP in that table to the base levels of employment and GDP (Pakistan National Income Statistics and World Bank Standards of Living Surveys), and then taking the percent in each column.

Results in Table 2.4 can be converted into the impact of employment growth in specific agricultural subsectors and for specific interventions. The conversion can be performed in two steps. First, the impact on GDP is estimated then used in the same manner as above to calculate the impact on employment. The incremental growth rates for each sector are based on the differing targets stated in Table 2.1 in the previous section. The employment impact figures are large due to the importance of agriculture to employment growth and because the focus is on aggregate impact and a corollary emphasis on those sectors that have large potential for aggregate growth.

It is widely believed (see Chapter 3 below) that agricultural policy in Pakistan has had a major detrimental effect on agricultural growth. For this reason, it is not unreasonable to believe that better agricultural policies would bring about a one percent increase in the agricultural growth rate. Using this assumption and the methodology outlined in Table 2.3, it is estimated that improved policies would create 1.2 million jobs, equivalent to 60 percent of the annual additions to the labor force.

Similarly, if the program for accelerated growth in dairy achieved a 3 percent addition to the dairy growth rate, then 0.9 million new jobs would be created. This result is based on the assumptions that 50 percent of agricultural GDP comes from livestock, that the dairy portion of that share is 70 percent, and that 70 percent of dairy growth occurs in the Punjab. This is to say that 25 percent of agricultural GDP is represented by the program target, with a 0.75 percent addition to the agricultural GDP growth rate and hence 0.9 million new employment opportunities. It is notable that the income and employment growth is generated largely by women, who provide the bulk of the labor force and management of the smallholder dairy sector.

By a similar argument, adding 5 percentage points to the horticultural growth rate would add 150,000 jobs annually. Using the same calculations, accelerating the growth rate in the wheat sector by one percentage point would generate about 168,000 jobs. Thus, along with rapid growth in the urban sector of 8 percent, employment would grow by an estimated three million jobs — one million more than labor force growth. About 80 percent of that growth would be due to agriculture and its employment multipliers to the rural non-farm sector.

In conclusion, a 5 percent growth rate in agriculture would substantially raise farm incomes and create substantial employment opportunities throughout the rural farm and non-farm sector. In contrast, if agricultural growth continues at its present 3 percent rate, employment growth will just match labor force growth and so there will be no decrease in underemployment or increase in real wages. Thus the focus of our recommendations is on maximum contribution to acceleration in the agricultural growth rate.

The difference between a 3 percent and 5 percent growth rate in agriculture represents the difference between (a) a significant increase in employment and substantial downward trend in poverty and (b) stagnation in employment and wage rates, and concomitant stagnation in poverty levels. Such a difference would have direct consequences on the welfare of millions of Pakistanis, with critical implications on national and regional stability.

2.4 The Functional Sources of Agricultural Growth in the Proposed Project Strategy

Our overall approach is to support the development and implementation of agricultural innovations through collaboration among farmers, the private sector, civil society, the research community, and public sector organizations. To this end, we have identified key priority areas of collaboration that will make a major difference in the growth rate of the three commodity areas selected for emphasis.

2.4.1. Applied Science to Agriculture

The engine of rapid growth in agriculture is practical application of modern biological science. Because of the location specificity of applied science to agriculture**,** robust national systems of research and extension are critical.

A major factor in Pakistan's poor record in agricultural growth is the lack of a vigorous agricultural research system at the national and provincial levels. There are also deficiencies in carrying research results through to the Pakistani farmer. At this stage of development, farmers — especially very poor, female dairy farmers — are not in a position to pay for needed technical services. It is widely acknowledged that the government extension system is limited by lack of technical competence and should be strengthened. It is also acknowledged that where private sector organizations (e.g., Nestlé Pakistan and Engro Foods Pakistan) or NGOs (e.g., Rural Support Programs or RSPs) are willing — with donor support — to extend those services to farmers, those non-governmental initiatives should be encouraged.

Thus, a major element of our approach is to use technical assistance from the world-renowned U.S. capacity to achieve a dual purpose: strengthen the applied agricultural research system, and forge a strong link between research and farmers. Government, private sector, cooperative and community organizations will all be used to facilitate that effort.

2.4.2. Policy

Pakistan is characterized by an unstable policy environment that provides low production incentives to farmers. There is also a lack of strategic analysis and priority setting to focus resources where they are most productive. To overcome these and similar policy constraints, we recommend the development of a world-class agricultural policy research institute to establish a unified, interactive policy research system in support of agricultural development in Pakistan. There is also a deficiency in capacity to evaluate contrasting approaches to agricultural growth and to draw recommendations for change from those studies. We recommend a strong monitoring and evaluation division in the proposed institute to bridge that gap.

2.4.3. Farmer organizations

Farmer organizations are now critical to coordinating the complex elements of a growth strategy at the farmer level. Such organizations are essential for credit provision, diagnosing and meeting specific needs of the production system, meeting increasingly high quantity and quality requirements, and many other rapidly changing needs. Thus, community organization is a major component of our recommendations. We propose building upon the sizeable institutional capacity already in place.

2.4.4. Infrastructure

Modern agriculture requires expensive infrastructure — roads, irrigation, and electrification. We state how our recommended efforts must be coordinated with investments in infrastructure. We also recommend a modest USAID contribution to irrigation infrastructure with emphasis on farmer organizations to ensure efficient use of water and adequate maintenance. Throughout, the emphasis is on building capacity in Pakistani institutions so that those institutions will continue after foreign aid has ended.

2.4.5. Private Sector

The private sector is central to our proposed strategy. We have identified key areas where technical assistance would be valuable to private sector entrepreneurs servicing agriculture. We have also enlisted the private sector in several aspects of the provision of key public goods to farmers. Two other elements of our private sector strategy merit particular mention. First, the project will pursue public-private sector partnerships in agricultural research and extension to help public research systems become more responsive to the needs of farmers. Second, the project will set in motion an incentive structure that would encourage the private sector to enter into contractual arrangements with farmer organizations and link delivery of public services to marketing and agribusiness development.

2.5. Institutional Development

Because the recommended interventions are aimed at accelerating aggregate national agricultural growth, aggregate national increase in employment, and poverty reduction, institutional development is at the core of the effort. This effort encompasses

strengthening institutions in the private, civil society, and public sectors. In view of the limited scale of much of the private sector engaged in agriculture, farmers and small enterprises serving farmers, civil society, and public institutions have a major role to play. The dairy component is the largest and most complex of the proposed activities and will require substantial institution building, but the other activities will also have significant institution-building requirements.

2.5.1. Private Sector Institutions

Farmers are, of course, the dominant private sector operatives in agriculture, but they are served by myriad private firms, ranging from a single donkey cart delivering water to animals, to motorcycle-mounted milk delivery, to large-scale integrated milk processing plants. The project in its entirety revolves around improving services to small-scale entities so they can expand and increase productivity.

The large-scale private sector institutions, including Nestlé Pakistan and Engro Foods, will have an important role in the project. Although they will continue to process only a small portion of total milk product marketing for the foreseeable future, their role will grow steadily. A key role for them in the project will be to develop new approaches in support of small dairy farmers. Those approaches will be monitored and evaluated as project activities proceed to synthesize best practices and lessons learned for widespread expansion.

2.5.2. Civil Society Institutions

A major function will be to coordinate the wide range of activities at the village level. To this end, the project will strengthen the capacity of civil society institutions, particularly the National Rural Support Program (NRSP) and the Punjab Rural Support Program (PRSP) — two institutions with a long history and successful record. To achieve the desired aggregate impact, their community structure will be greatly expanded to provide complete coverage of the Punjab for dairy production. Similar efforts will be undertaken relative to the other commodities. When appropriate, the structure built for dairy will be expanded to cover the non-dairy sectors.

2.5.3. Public Institutions

The project will strengthen two major sets of public institutions, those related to research and extension and those related to agricultural policy.

2.5.3.1. Applied Research and Extension

A major effort to strengthen applied research and extension in Pakistan is justified on several grounds.

First, it is now well established that applied research can contribute significantly to raising agricultural productivity and output. This, in turn, can increase farm income and lower the cost of food for consumers. Because of the location specificity of applied science to agriculture**,** strengthening national research and extension systems is a critical component of a country's agricultural growth strategy.

Second, research studies have consistently reported high returns to agricultural research throughout the world. For instance, in 35 studies published over 1965-2005, the median[14] estimate of the social rate of return was 45 percent per year (Pray and Fuglie).[15] A study specific to Pakistan (Nagy 1989) shows similar rates of return to agricultural research.

Third, a major factor in Pakistan's poor record in agricultural growth is the low level of expenditure in agricultural research compared to other developing countries. A recent study (Beintema et al.) indicates that agricultural research and development (R&D) spending, measured by R&D as a percentage of the agricultural GDP, is over 30 percent lower in Pakistan than in Bangladesh, India and Sri Lanka, and 40 percent lower than the average for the Asia-Pacific region. It is striking to note that the differential is significantly higher for sub-Saharan Africa (66 percent) and the average for developing countries (55 percent). The same study shows that agricultural R&D spending in Pakistan declined by 40 percent between 1991 and 2003.

Fourth, the low level of expenditure in agricultural research in Pakistan is all the more unfortunate because several studies have documented that the rate of return from the country's past agricultural research is high. The overall internal rate of return from agricultural research ranged between 57 and 65 percent — returns that compare favorably with what would be considered a high return from other public and private investments (Pray and Fuglie, and Nagy).

Fifth, it is sometimes argued that applied research in Pakistan should be conducted by the private rather than the public sector. It must be remembered, however, that the country's political and economic climate, together with unresolved intellectual property rights and difficulties associated with regulation enforcement, is likely to continue to dampen the potential of private agricultural research. Most important, there is unquestionable evidence that public research and private research are not mutually exclusive, but rather go hand in hand. This complementarity applies to developed and developing countries alike. For instance, public and private research expenditures and research intensities are positively related in many Asian countries (Pray and Fuglie). One of the factors that explain this complementarity is that public research institutions and universities reduce the cost of research inputs for private companies, especially by expanding the available pool of scientific and technical personnel.

Sixth, it is also often argued that, although agricultural research generates long-term benefits, an investment in research entails a long time lag before it produces tangible economic impact. Current research on this topic, however, suggests that, on average, public agricultural research undertaken today will begin to noticeably influence agricultural productivity in as little as two years and that its impact could be felt for as long as 30 years (Fuglie and Heisy). The emphasis in this project on applied research and on strengthening the link with technically competent extension services should further shorten that lag.

The research and extension institution-building effort under the proposed interventions will have two thrusts. The first is applied research, primarily in the provincial agricultural universities.

[14] The median is the value for which there is an equal number of items with values below it as above it.

[15] Returns to agricultural research are reported as a percent return on each dollar spent on research per year. For instance, a rate of return of 45 percent means that each dollar spent on agricultural research returns $0.45 per year.

The agricultural research system in Pakistan is generally believed to have deteriorated significantly over the past decade or so. The weakest link is applied research — molding experiment station results to the practical exigencies of small farmers. To strengthen this function, technical assistance will be used to provide hands-on demonstration trials on farmers' fields and links to extension.

The number of professionals able to conduct such applied research will be sharply expanded through PhD-level training in the U.S. with the applied research working back to more basic research and forward to farmers' fields. This improved capacity will be used to link practical applications with the existing agricultural extension system to enhance its technical competence. While private sector extension will be pursued vigorously under the project (see above), the focus on aggregate national impact will require that the current public expenditure on extension be made more effective. Linking applied research and extension will be achieved through technical assistance provided by the U.S. land grant systems and civil society organizations at the village level.

The second objective will be to rejuvenate the large public-sector extension system through improved technical competence and, in some cases, increased operating budgets. The budget gaps can be addressed through a dialogue with relevant government authorities for more adequate funding, as well as through resource mobilization from other sources in collaboration with civil-society organizations. The link to applied research will provide the basis for demonstrations in farmers' fields and short courses that will prepare extension personnel with the necessary technical knowledge.

2.5.3.2. Agricultural Policy

There is consensus in Pakistan that rapid agricultural growth will not be achieved without a stronger agricultural policy research and analysis capability. For this reason, it is recommended that substantial effort be devoted to building national agricultural policy research capacity. The objective will be to establish an agricultural policy research institution with strong analytical resources, sufficient autonomy and access to decision-makers. (A detailed presentation of the structure and characteristics of this institution will be provided in Section 3.1 below.)

CHAPTER 3: PROJECT COMPONENTS

3.1. Value Chain Development and Implementation

We propose a multi-faceted, yet highly focused and well-integrated intervention in the area of applied research and value chain development and implementation. Our intervention has a policy component and three commodity-oriented components — dairy, horticulture and wheat. A cross-cutting biotechnology research activity is also recommended to support biotechnology applications in the agricultural crop development effort.

3.1.1. Agricultural Policy Research Institute

3.1.1.1. Rationale

In recognition of the importance of agricultural policy to the growth of the agricultural sector and the national economy, and in view of the parlous state of policy research and analysis in Pakistan, we recommend the development of an agricultural policy research institute to establish a unified, interactive policy research system in support of a more vibrant agricultural economy.

Establishing and institutionalizing an agricultural policy research institute in Pakistan is justified on several grounds. First, the design team interviewed various donor representatives and a large number of prominent Pakistani social and political scientists and opinion leaders. It was universally agreed during those interviews that policy was a vital element of a prosperous, growth-oriented agricultural sector.

Second, while some exceptions emphasized the importance of pressuring the government to apply well-known policy answers to well-known policy questions, the majority of those interviewed believed that donor pressure had little impact on agricultural policy change. On numerous occasions, donors such as the Asian Development Bank and the World Bank have tried to condition loans on implementation of major policy changes. Yet, even with considerable aid funds hanging in the balance, efforts by donors to change policy through loan conditioning and exhortation have not been successful, particularly in socially sensitive areas such as wheat price policy or water-user associations.

Third, change is likely to come when based upon careful analysis and priority setting. This is particularly true in countries such as Pakistan where the policy environment is unstable and does not provide sufficient production incentives to farmers, and where there is a lack of strategic analysis to focus resources where they are most productive.

Fourth, to ensure ownership and enhance sustainability, policy analysis should be in large part carried out by Pakistani professionals.

Fifth, there is a virtually unanimous view that agricultural policy research should be conducted under an institutional structure that provides a critical mass of analysis, findings and policy options; continuity; and ready access to decision-makers and other policy users.

Sixth, to be most effective, that critical mass of research should be associated with a reputation for objectivity, analytical rigor, and lack of political bias.

Seventh, there is a successful precedent for such an agricultural policy research body in Pakistan in the form of the Agricultural Prices Commission (see below).

3.1.1.2. Institutional Location and Conditions for Success

For the proposed agricultural policy research institute to be successful, it has to be designed as a world-class organization and be housed in the most suitable institutional location.

The location of the agricultural policy research institute was one of the most critical issues when the concept of its establishment was considered by the design team. About 30 Pakistani officials, eminent economists, academicians and thought leaders were consulted — including former agriculture and finance ministers, and those who played a key role in the Agricultural Prices Commission, an organization that was established in 1981 through a Resolution of the Ministry of Food, Agriculture and Livestock (MINFAL).[16]

In essence, our recommendation reflects a consensus derived from those broad consultations and extensive discussions. The conclusion from those discussions is that the agricultural policy research institute should have the following major characteristics:

Institutional Affiliation Its relation to MINFAL — its most important consumer of output, as well as its key source of data and definition of issues — is viewed as an essential condition to its effectiveness and expected impact.

Autonomy To be autonomous from undue political influence, such as determination of leadership, staffing and research agenda, it should have a governing body consisting of high-level, politically influential representatives from key private and public institutions and a high-level chairman. Its board of governors should appoint a director with ready access to the highest levels of government.

[16] In May 2006, the Agricultural Prices Commission was restructured into the Agricultural Policy Institute (API) as an Attached Department of MINFAL. According to MINFAL, API's mandate is to:

- examine/evaluate domestic and international sectoral/commodity-specific policies;
- conduct studies on emerging policy issues relating to input/output production, consumption, prices, costs, marketable surplus, demand, supply, stock, trade;
- examine/estimate production, processing, storage, and marketing costs of agricultural
- commodities (crops and livestock);
- recommend policies and programs to reduce such costs and improve the competitiveness of commodities;
- analyze the impact of important agricultural policies on producers, consumers, processors and exporters;
- advise on policy adjustments needed for greater efficiency and equity;
- develop API to international standard through foreign training; and
- integrate national research organizations/institutes with international centers.

Technical Assistance It should receive technical assistance from an international research institution with a long-standing track record in agricultural policy research in a variety of developing-country settings, particularly in Asia. A reputable and experienced international research institution, together with USAID constant oversight, will ensure independence of the research agenda and integrity of findings and recommendations.

Government Support Several years of protection by USAID through a distinguished international research institution is a prerequisite for success, but tangible financial support from the Government of Pakistan will strengthen ownership and significantly enhance sustainability of the effort.

Much of what is required is in existing statutes of MINFAL's Agricultural Policy Institute. The statutes have crossed all legal hurdles, except for final approval by parliament — which, according to knowledgeable individuals, could be accomplished without much delay. Modest changes to the statute could be made, including addition of a monitoring and evaluation division with wide responsibilities that encompass identification of best practices from the project's range of activities in the dairy and other sectors. Other adjustments might also include replacing the chairman of the governing board and altering board representation to strengthen autonomy.

Other negotiations with the Government of Pakistan will be needed to ensure adequate staffing, proper implementation, counterpart initial financial support, and increased future support as USAID funding is phased out.

3.1.1.3. Alternatives Considered

While considering agricultural policy research options, a wide range of alternative homes for the proposed institute were considered.

The most obvious scenario would be to make the institute an autonomous body relating to the Planning Commission, rather than the Ministry of Food, Agriculture and Livestock. Though a viable option, two concerns associated with this model can be identified. First, incorporating USAID's Pakistan Food and Agriculture Project policy research agenda into the policy research arm of the Planning Commission, the Pakistan Institute of Development Economics (PIDE), would have a detrimental effect on the project's policy research function. PIDE is sufficiently powerful that it will entirely absorb that function — reducing the agricultural element's visibility and relevance, and diminishing the impact on the Ministry of Food, Agriculture and Livestock and associated organizations at the national and provincial levels. Second, PIDE may not be able to deal with the wide range of technical policy issues critical to agriculture, which clearly fall under the jurisdiction of the Ministry of Food, Agriculture and Livestock.

Another alternative would be placing the agricultural policy research institute at an agricultural university, such as Faisalabad. The main concern associated with this option is that the institute would have less prestige under this umbrella than as a free standing, autonomous institute. Similarly, because of geographic removal from Islamabad, it would have less relevance and minimal impact. There is also concern that it would drift into excessive emphasis on more micro-problems, rather than focus primarily on the large strategic issues that are, at present, so central to decision-making.

A third alternative would be to place the agricultural policy research institute at a major non-agricultural institution such as Lahore School of Management Sciences (LUMS). However, two disadvantages associated with this scenario can be identified. First, as noted under the previous alternative, removal from Islamabad would reduce the project's impact on the national policy debate related to major agricultural policy issues. Second, there are few examples of agriculture-focused policy bodies that have survived in non-agricultural institutions. An exception was, for many years, the very prestigious Food Research Institute at Stanford University. And even that celebrated institution was abolished several years ago, succumbing to weak understanding of, and fragile support for, agriculture in a non-agricultural setting.

Associating the Institute with USAID's Pakistan Economic and Agricultural Reform (PEAR), or a similarly structured future effort would significantly downgrade the importance of our proposed initiative. PEAR is designed to establish a consortium of public policy institutes, universities and agriculture research organizations to meet government and donor demand for improved monitoring, impact, learning, and policy dialogue and formulation for economic management. Although this objective is relevant to the proposed Agricultural Policy Research Institute, the agricultural policy agenda is likely to lose its status as a primary activity within PEAR's larger context. As stated, the overwhelming record on agriculture subsumed into non-agricultural initiatives is that the agricultural effort quickly becomes weighed down by the other activities and ends up without any meaningful bureaucratic and political support.

3.1.1.4. Structure and Agricultural Policy Research Content

Research Divisions As previously noted, the proposed Agricultural Policy Research Institute would have a high-level government board, and status and salary levels that would attract an effective director and top-level staff. It would have six divisions: (1) Agricultural Strategy and Priorities, (2) Trade, (3) Production, (4) Consumption and Nutrition, (5) Marketing and Agribusiness, and (6) Monitoring and Evaluation. Each of these divisions will make an important contribution to the various programs comprising the Pakistan Food and Agriculture project.

Monitoring and evaluation A monitoring and evaluation division is included to improve decision making and enhance project performance through identification and dissemination of best practices and lessons learned within each project component and across components. The monitoring and evaluation function under the Pakistan Food and Agriculture project will be a fundamental determinant of project success. A results-based monitoring and evaluation system with a poverty-reduction focus will be all the more important due to the multiplicity of approaches and community-driven initiatives used, and the need for rapid management reaction.

Strengthening of agricultural statistics Because good policy analysis requires good data, we also recommend a modest strengthening of agricultural statistics by improving the area sampling procedures through the use of GIS and satellite imagery for crop reporting.

3.1.2. Smallholder Dairy Development

3.1.2.1. Project Interventions

Our approach to dairy development in Pakistan has several thrusts. First, dynamic growth capacity will be strengthened by ensuring a steady flow of applied research results, and by using applied research professionals to upgrade the technical competence of the extension service. The result will be increased productivity and competitiveness. Second, where local government institutions remain unable to effectively deliver services to farmers, direct interventions through community organizations, NGOs and private sector entities will be needed. To ensure long-term sustainability, however, it is important that these channels do not undermine devolution initiatives intended to strengthen local government institutions.

Most milk production continues to be marketed through traditional channels. Significant productivity gains for smallholders are possible with better farm-management practices, improved feeds, better veterinary services, and improved marketing channels. A number of private and cooperative organizations (see below) offer alternative mechanisms for delivering the requisite technology, veterinary services, and marketing alternatives to small farmers. To help ensure higher productivity and more remunerative prices of milk for farmers, those alternatives will be strengthened and expanded.

A rigorous comparative analysis of those alternatives will be conducted by the Agricultural Policy Research Institute, beginning with the first year of project implementation, to synthesize best practices and lessons learned. Project activities will be adjusted as needed based on findings and recommendations.

Third, a system of community organizations will be built to coordinate, organize and ensure provision of micro-credit, skills training and other private services needed for rapid growth of the smallholder dairy sector. This task will be implemented through Rural Support Programs (RSPs). RSPs have independent and autonomous boards of directors that work in a voluntary capacity and a team of highly qualified professionals.

Mobilization of economically, socially or politically marginalized groups has been an integral part of RSPs. These have broad coverage of all districts in Punjab, although at a relatively low level of intensity. More-intensive coverage will be required to achieve the targeted aggregate impact. This, so to speak, is the rollout, but it should begin immediately.

Fourth, village-level entrepreneurs are needed for a wide range of activities. Community organizations will help diagnose those needs, along with applied-research staff, and the project will assist in the financing. Examples might include a donkey cart to carry water to the animals, village-based cooler and village-based motorbikes with insulated containers.

3.1.2.2. Local Institutional Context

3.1.2.2.1. Applied Research and Extension

This is the segment that will ensure sustained decreases in the cost of production as a means of increasing competitiveness.

Faisalabad Agricultural University

Faisalabad Agricultural University is the lead agency for the applied research in Pakistan. The staffing there is generally superior to that of the Ayub Institute, with higher salaries and more prestigious appointments. Although provincial research in Punjab is supposed to take place at the Ayub Agricultural Research Institute (see below), the university conducts considerable research with special funding. The design team met with the acting vice-chancellor and with key researchers, and at greater length with the university's corps of agricultural economists. When meeting informally at a later date, the vice-chancellor expressed enthusiasm for the project concepts set forth here. Faisalabad Agricultural University coverage would be for fodder and feed crops, and livestock nutrition and health.

Ayub Agricultural Research Institute

At the provincial-government level, agriculture is divided into crops, livestock and fisheries, food, natural resources and education. While research conducted by the federal agencies is largely long-term priority research, research conducted by the provincial research system is mostly adaptive in nature. Each of the four provinces has an agricultural research institute under the administrative oversight of the Department of Agriculture. The Ayub Agricultural Research Institute in Punjab is the largest of the four.

An effort should be made to include the Ayub Agricultural Research Institute in project activities. Ways that might occur were not pursued by the design team.

University of Veterinary and Animal Sciences, Lahore

Nestlé Pakistan has a close working relationship with this institution, which the team did not visit. Interaction with the university could be handled by Nestlé – an arrangement that would reflect their current collaboration under an ongoing UNDP-funded livestock project[17] without additional support for the university's research and extension. Alternatively the university's applied-research capacity could be built along with that of Faisalabad.

3.1.2.2.2. Community Organizations

This is the core of the project's effort at the grassroots levels. The role of community organizations will be to:

- Mobilize and organize farmers
- Act as facilitators among the Government of Pakistan, USAID, and organized communities to ensure project service delivery at the grassroots level
- Support the applied research and extension system for dairy

[17] Nestlé Pakistan and the University of Veterinary and Animal Sciences in Lahore collaborate under the Community Empowerment through Livestock Development and credit (CELDAC), a UNDP initiative that addresses each stage of the value chain for milk, beginning with raising cows that produce milk which is then transported to a central processing plant where it is pasteurized, homogenized, processed and graded into different fat contents, and bottled and marketed. The ultimate goal of the project is to create a cadre of rural women entrepreneurs who can play a leading role in enhancing livestock management at the grassroots level.

- Identify entrepreneurial activities at the village level, including those related to cooling tanks, insulated tanks for marketing, and feed mills
  - Since modern capacity is very limited at this level, the bulk of increased milk production will be marketed using improved, but traditional methods
- Manage an initial dairy credit program in selected districts
- Mobilize resources, including credit, from other development partners

One of RSPs' strategic goals is to increase communities' income-earning potential through micro-credit, grant funding of community physical infrastructure, capacity building and training for employment. All RSPs share the same objective as that of the Pakistan Agriculture and Food Project: reducing poverty and improving the quality of life for the poor. They also act as facilitators among government institutions, development organizations, and organized communities to improve service delivery at the grassroots level.

As detailed below, The National Rural Support Program (NRSP) and the Punjab Rural Support Program (PRSP) are two NGOs with a presence in every district in the Punjab.[18] The two organizations have large-scale operations, are highly experienced and well administered, and are prepared to make major expansions. Their role under the project is expected to be substantial.

National Rural Support Program (NRSP)

NRSP is the largest of the RSPs, with a presence in all provinces and Azad Jammu & Kashmir. It implements a variety of development projects financed by local institutions and international donors. It is the largest microfinance institution working in rural and urban areas. NRSP's Institute for Rural Development imparts training related to participatory development in other development areas.

Project objectives and potential activities were discussed at length with NRSP representatives, who expressed enthusiasm to work with USAID.

Punjab Rural Support Program (PRSP)

PRSP's core programs – social mobilization, training and microfinance – are managed by six regional offices located in Faisalabad, Gujranwala, Lahore, Multan, Sahiwal, and Sialkot. Those offices operate through 60 social mobilization teams located in 33 centers in 20 districts. As of March 2008 PRSP organized nearly 400,000 community members into nearly 24,000 community organizations, of which over 40 percent were women.

PRSP implements short-term projects in health, education and livestock support such as the Establishment of Milk Processing Plants and the Special Initiative for Livestock Sector. PRSP was provided with an endowment fund by the Government of Punjab when it was

[18] More generally, the Rural Support Programs Network (RSPN) — a platform for nine Rural Support Programs (RSPs) in Pakistan — has a large presence of over 100,000 community organizations across 93 of the country's 140 districts and two FATA agencies. RSPN uses innovative partnerships with the public and private sectors for improved service delivery through its vast network of organized communities. RSPN's social mobilization involves a series of community dialogues with women and men that result in the formation of community organizations at the sub-village level, village development organizations at the village level, and local support organizations, commonly at the union council level. RSPs capacity to assist USAID may be illustrated by the fact that, in addition to its many other activities, RSPs had a credit portfolio of about $60 million in 2007, with over 400,000 borrowers, of which over 40 percent were women.

set up in 1998. It implements development projects for the Government of Punjab, the federal government, and the Asian Development Bank, among others.

Project objectives and potential USAID's partnership activities with PRSP were discussed only during the design team's discussions with NRSP representatives, who were confident that PRSP would be keen to participate.

3.1.2.2.3. Modern Milk Processing Organizations

There are four major modern milk processing organizations. They all pasteurize and otherwise process milk under modern conditions. They each receive support from donors to implement specific small-farmer dairy activities. These organizations offer alternative mechanisms for delivering the requisite technology, veterinary services and marketing alternatives to small farmers. They currently reach a relatively modest proportion of farmers, but they stand ready to expand coverage as needed. Each organization is expected to work along its current activity lines, although at a much larger scale. Their programs offer ample opportunity for a well-managed dairy support effort, but their activities will need to be evaluated as the program proceeds to maximize program impact and enhance sustainability of the effort.

Nestlé Pakistan

Nestlé Pakistan is a subsidiary of the Switzerland-based Nestlé SA. It started operation in 1988, when the parent company first acquired a share in Milkpak Ltd. Nestlé Pakistan receives support from UNDP to assist with the implementation of a livestock program at the village level in Punjab. A series of discussions with the design team indicate that Nestlé is eager to expand its technical support activities and work with USAID under the new Pakistan Agriculture and Food project.

Engro Foods Pakistan

Engro Foods, a subsidiary of Engro Chemical Pakistan Limited[19] had its first full year of operations in 2007. The company continued expanding with additions to brand portfolio, milk production and distribution capacities. Its portfolio includes four brands: Olper's milk, Olper's cream, Olwell and Tarang. Engro Foods (Engro) operates two dairy processing factories located in Sukkur, and Sahiwal. The company's milk collection network now has over 700 village milk collectors and 400 milk collection centers covering 2,400 villages and over 50,000 farmers across Pakistan. One of its new ventures is the diversification of its dairy portfolio into ice cream scheduled for 2009. Another activity is the establishment of a dairy farm with milking expected to start in the second quarter of 2009.

Engro is a second partner, along with Nestlé Pakistan, under the current livestock project funded by UNDP. Although Engro plans to expand its activities outside Sindh and southern Punjab, its core activity is expected to remain in Sindh. Sindh institutions' support to the project could be handled through Engro.

***The Pakistan Dairy Development Company* (PDCC)**

[19] Engro Chemicals consists of five subsidiaries and a joint venture. Engro's business lines include chemical fertilizers, PVC resin, a bulk liquid chemical terminal, industrial automation, foods and power generation.

PDCC is a semi autonomous government organization established in 2005 as a public-private partnership to coordinate the dairy development activities of the private sector. A board of directors governs the company with representatives from the industry, farmer groups, academia and the government, but a majority of its directors are from the private sector. According to its articles of association, the chairman must be from the private sector. PDCC is eager to work with USAID. However, since PDCC tends to deal with relatively large-scale operations (50 cows per farm on average), its willingness to work with small farmers (under 5 milking animals) is unconfirmed.

Idara-e-Kisan or Hala Dairy

Hala Dairy is a vertically integrated dairy cooperative with over 20,000 members in over 500 villages in Punjab. The cooperative is open to any livestock farmer in a target village that owns one buffalo or cow and is able to supply 300 liters of milk in a six-month period. *Hala* Dairy collects milk from thousands of geographically dispersed members. Milk is processed in one of the cooperative's milk processing plants and marketed to urban consumers through retail outlets. The cooperative uses profit from its commercial operations to subsidize a package of veterinary and livestock extension services delivered to members through private contractors.

The design team did not meet with *Hala* Dairy officials, but discussed its potential interest to participate in project activities with the president of the Pakistan Agricultural Research Council (a senior member of *Hala*'s board of directors) who confirmed that the organization had significant expertise in the dairy sector and was willing to offer its technical and management expertise to the USAID initiative.

3.1.2.2.4. Monitoring and Evaluation

In view of the multiplicity of approaches and actors, and to maximize efficiency of resource use, a monitoring and evaluation function will be essential. This function will be performed by the Agricultural Policy Research Institute (see details below).[20] The Agricultural Policy Research Institute will perform the following monitoring and evaluation tasks:

- Conduct periodic evaluation of program approaches used by RSPs and each other partner
- Assess quality optimization of the programs in a context of rapid expansion and scale-up
- Identify approaches and implementation mechanisms most likely to maximize the impact of the dairy program and enhance its sustainability
- Reallocate support program resources accordingly

The current statutes of the Agricultural Policy Research Institute do not explicitly include a monitoring and evaluation function, so this question will have to be resolved in conjunction with other institutional arrangements relative to the agricultural policy research component.

[20] Note that the Agricultural Policy Research Institute will have an equally vital role in support of the other project components (horticulture, wheat and small-scale irrigation).

3.1.2.5.5. Credit

- The project will include a substantial credit scheme for small enterprises at the village level
- Microcredit institutions are important and could play a major role in lending to small dairy operations (one or two cows). Meetings with such institutions were not held.
- Credit should be coordinated by PRSP and NRSP. As previously noted, the two organizations have considerable expertise in this area and are keen to assume that responsibility
- The design team held discussions with the president and the full board of directors of the Agricultural Development Bank. Great enthusiasm was shown for making more loans to small dairy farmers. In practice, this effort will require significant design, management, monitoring and evaluation input from the RSPs and the Agricultural Policy Research Institute

3.1.2.3. Expected Benefits

In assessing the impact of each program intervention, the following four caveats should be made:

1) The project is designed to have a national aggregate impact, with a necessarily small effect at the individual level.
2) Estimating returns when the expected change can be directly attributable to a limited intervention is more accurate than when the objective is to assess the impact of a more comprehensive program aimed at aggregate change. Hence, the estimates presented here should be viewed as rough approximations that should be used with caution.
3) In keeping with national impact, the presentation is initially in percentage terms. That builds in compounding — an important element of growth — and facilitates comparisons with other percentage changes.
4) Moving to absolute numbers involves rough approximations not only because the estimates reflect national aggregate impact, but also because the statistical base is weak for several items. [21]

The national change targeted for the dairy sector is to pick up the growth rate from the current annual 2.5 percent (estimate from Nestlé Pakistan) to 6 percent, for an increment to the annual growth rate of 3.5 percent. The current rate of growth of demand is estimated by Nestlé Pakistan to be 5 percent. The additional percentage point to achieve 6 percent assumes an overall acceleration in per capita income growth of two-thirds of a percent from the present point and an income elasticity of demand of 1.5 (FAOSTAT).

[21] The caveats listed here also apply to estimated benefits for wheat, horticulture and biotechnology (see below).

There are approximately 6 million small dairy farmers in Pakistan,[22] of which about 4 million are in the Punjab.[23] If half the dairy animals were reached by the program (which would be somewhat less than half the dairy farmers), then we obtain the following results:

- Over 1.5 million women beneficiaries. This estimate assumes 1.25 milking animals per farm and all dairy animals are looked after by women. The program would work to increase the extent to which women actually managed the money from dairy activities, as they do in India
- Their incomes from dairy would grow by 7 percent per year faster than at present. To achieve the overall incremental 3.5 percent in the growth rate with half the animals participating the growth rate has to be twice the 3.5 percent or 7 percent for those animals and the feed must be largely produced on the farm
- Based on a 7 percent annual rate of increase in production, that would increase dairy income by annual increments of about $250 per farm — for a total of $375 million per year increase in aggregate income, considerably more than the total cost of the dairy program over a five-year period ($225 million). This is possible in large part because a large volume of other resources are activated from those of the farmer to the existing extension services

In summary, for a $225 million total USAID expenditure on the dairy project, the following benefits would be expected:

- 1.5 million participating women would have incomes significantly increased
- Average incomes of participating women would be raised by $250 each year
- Total annual increase in income would be $375 million
- Per capita milk consumption would rise by about 2 liters per year, with a major impact on nutrition

3.1.3. Smallholder Horticulture Development

3.1.3.1. Project Interventions

3.1.3.1.1. Applied Research and Extension

The basic approach for this sector is similar to the plan for dairy, with applied research holding even more importance. A typical horticulture scenario in developing countries is that a commodity will grow very rapidly but be caught by a market demand shift or disease and be unable to adjust. In developed countries, biological and market research anticipates these problems and creates specific applied solutions. It is essential that Pakistan build such a capacity immediately. Biotechnology is already making an impact elsewhere on horticulture disease resistance and quality.

Competition is constantly changing prices and the cost of production in export commodities; a research system must ensure that Pakistan stays current or they will face

[22] Figure extrapolated from agricultural census data; consistent with discussions at Nestlé Pakistan in Lahore.

[23] Punjab, where the bulk of dairy activity will be concentrated, accounts for about 70 percent of the country's dairy sector.

the prospect of losing market competitiveness. The single most important element in maintaining agricultural competitiveness is research and its effective application.

If the existing research system continues to lag, Pakistani agriculture will gradually recede into low-income subsistence production – with noticeable effects of slow employment growth, rising poverty and instability – instead of blossoming into smallholder commercial farming.

3.1.3.1.1. Value chain development and implementation

Connecting the value chain all the way to the export market will be of critical importance in horticulture. Increasing the price of water rights so that they more closely reflect the opportunity cost of water would promote cultivation of high-value fruits and vegetables. Strengthening farmer organizations and promoting new forms of marketing arrangements, such public-private partnerships and contract farming, would increase sales volumes and raise prices to farmers.

Comprehensive support to value chain development and implementation will be provided in collaboration with the existing Task Force for Horticulture Finance and Competitiveness. Areas of intervention (corresponding to the four subcommittees of the task force) include: (1) production, processing and marketing; (2) quality, standards and regulations; (3) infrastructure such as integrated cool chains, laboratory services and transport infrastructure; and (4) finance. The marketing and agribusiness unit of the Agricultural Policy Research Institute will also play an important role in this process. As the project proceeds, a number of collaboration and operating models will be explored. The Monitoring and Evaluation unit of the Agricultural Policy Research Institute will carry out in-depth studies to identify best practices in smallholder horticulture.

3.1.3.2. Local Institutional Context

Close collaboration with the existing Task Force for Horticulture Finance and Competitiveness (TFHF&C) will be essential. TFHF&C provides three critical services for horticultural development in Pakistan: general guidance, coordination and support, and expertise provided by the active implementing agencies.

TFHF&C members include the Ministry of Finance; the Ministry of Food, Agriculture and Livestock; the Board of Investment; commercial banks; the Ministry of Commerce; the Ministry of Industry; and the Ministry of Health. TFHF&C works through an implementation committee and four subcommittees (horticulture business finance; quality standards and regulations; infrastructure; and production, processing and marketing).

Active agencies within the implementation committee include the Ministry of Food, Agriculture and Livestock, the Pakistan Horticulture Development Board, the Trade Development Authority of Pakistan (earlier known as the Export Promotion Bureau), the provincial secretaries of agriculture and industry. Those agencies work in close collaboration with farmers and private sector companies, including exporters, donor agencies, universities, and NGOs.

The sub-committee for horticulture business finance serves as a catalyst for ongoing and planned interventions and assists in the development of guidelines for this aspect of the industry. The subcommittee for quality standards and regulations ensures that the highest possible standards are developed for both exports and the domestic market. The subcommittee for infrastructure ensures that all relevant actions are taken in developing the needed infrastructure to facilitate production, post-harvest handling, storage, transport, processing and export (by sea, land and air). The subcommittee for production, processing and marketing coordinates all activities and projects undertaken at the federal, and the provincial levels related to the main elements of the horticulture value chain.

USAID assistance to the horticultural sector under the Pakistan Food and Agriculture Project would best be implemented using the TFHF&C institutional framework. A detailed discussion with the TFHF&C chairman and other relevant members will be needed to identify the most suitable arrangements.

As in the case of dairy, community organizations will be needed, and mobilizing such organizations will be a high priority. Again the applied research professionals, working with the community organizations, will play an important role in ensuring the optimal technical orientation of these organizations. (For details on community organizations, see Section 3.1.2.3.2.)

3.1.3.3. Expected Benefits

The national change targeted for the horticultural sector is to increase the annual growth rate from the current three percent to eight percent, representing an incremental growth rate of five percent.

There are approximately 500,000 small horticultural farmers in Pakistan.[24] If we consider that 60 percent (or 300,000) of those farmers are engaged in the four priority crops (citrus, mango, potato and onion), then we obtain the following results:

- About 300,000 farm families move from substantial deficit in key micronutrients to full micronutrient requirements. In an intensive study of horticultural farmers in Nepal,[25] it was found that the increase in horticultural consumption was far greater than that predicted by the impact on income and standard income elasticity of demand. Consumption increased because, in horticulture substantial quantities of low-quality products that do not meet market quality standards are produced. A major ancillary benefit of increased smallholder horticultural production is that the largely unsold commodities are consumed at home even by the very low-income farmers, with significant improvement in their nutrition status.
- The incomes from horticultural production for the 300,000 horticultural farmers would increase by 5 present per year faster than at present.
- Assuming an 8 percent production growth rate, yields an annual (compounded) increment of $43 million — or $143 per farmer engaged in the four priority commodities. With 5 percentage points of that 8 percent generated by the

[24] Extrapolated from agricultural census 2000 data for orchards of 277,000 farmers and adding a similar number for vegetables to round to 500,000 farmers for both fruits and vegetables.

[25] USAID MARD project special studies (1993).

program, $89 of the $143 can be directly attributed to the USAID initiative — for a total of $27 million compounded at 5 percent annually. This is possible in large part because of the increased productivity due to the applied research and extension program, area expansion as a result of higher profitability, and increases in private sector efficiency.

In summary, for about $50 million total USAID expenditure on the horticultural sector, the following benefits would be expected:

- 300,000 participating farmers would have incomes significantly increased;
- Incomes of participating farmers would be raised by $89 per year on average;
- Total annual increase in income would be $27 million;
- Average per capita horticultural consumption would rise throughout the country, especially among the very low-income horticultural farmers, with a major impact on nutrition.

3.1.4. Smallholder Wheat Development

3.1.4.1. Project Interventions

Wheat represents 14 percent of agricultural GDP and is by far the most important element in the country's food security. Although it will be difficult to exceed a 3 percent growth rate in this subsector, achieving that result requires vigorous adaptation and application of basic knowledge. To maintain that rate into the indefinite future requires a dynamic applied research system — as well as rapid development of biotechnology capacity. A 3 percent growth would end imports in most years. Export-parity pricing will also ensue, with beneficial effects on the poor.

The thrust of this effort is similar to that for dairy and horticulture: building the applied research system (currently very short in both numbers and application) as the basis for on-farm change, and building technical capacity of the extension system. For wheat, the existing system will be used because the private sector does not see money to be made in this area. Building community organizations to link applied research and extension will therefore be a critical first step to raise subsector productivity. The Agricultural Research Policy Institute will pay considerable attention to the various policy issues related to wheat. Seed policy will be a first priority.

3.1.4.2. Local Institutional Context

The local institutional arrangements for wheat are much simpler than for dairy or horticulture. The wheat program is envisaged as more of a pure applied research and extension effort, with other aspects such as credit reasonably in place. Applied research, with strong links to extension, must be developed with the relevant four agricultural universities. When the design team discussed project activities with Faisalabad Agricultural University, it received an enthusiastic welcome.

In the Punjab, NRSP and PRSP may be needed to help coordinate the applied research and extension initiative. Establishing the link with extension in the other provinces can be left to the applied research professionals at their respective universities.

As previously noted, the Agricultural Policy Research Institute will devote sufficient attention to wheat policy research, including price policy.

3.1.4.3. Expected Benefits

The value of wheat production in Pakistan is $5 billion, with a growth rate of about 3 percent. The objective of the wheat program is to maintain the 3 percent growth rate with a one percent per year decline in area cultivated due to an expected shift to higher-value commodities. The shift to higher-value crops results in a one percent growth in productivity per year. That provides an annual increase in value of output attributable to the applied research and extension program, community organization and related activities of $50 million per year.

Assuming that the project will allocate a total of $50 million to applied research and extension and associated value chain support in the wheat sector, it is estimated that the project's total expenditure over five years will be offset by its expected benefits over a single year.

3.1.5. Biotechnology Research Support

3.1.5.1. Rationale, Interventions and Local Institutional Context

There is abundant rationale for supporting biotechnology to achieve meaningful agricultural growth in Pakistan. In the long run, biotechnology capacity is essential to sustained increase in agricultural productivity. Recombinant DNA[26] is the basic science breakthrough one and a half centuries after the previous pure science breakthrough (Mendelian genetics), whose enormous impact on agricultural yields is running out.

There is also short-run capability in Pakistan for biotechnology applications in horticulture, rice, and perhaps wheat (cotton is dominated by private firms, particularly Monsanto). Pakistan needs technical assistance to reach competitive capability. Additionally, the U.S. has a major interest in intellectual-property-rights positions favorable to biotechnology development. Building a domestic advocacy group through the support of the domestic research capacity is a proven way to build advocacy for biotechnology support. The very positive U.S. biotechnology development experience in Indonesia represents a compelling reason for supporting biotechnology research in Pakistan. Sixth, the investment in biotechnology development in Pakistan envisaged under this project is very small, and so a single breakthrough in research or change in legislation would yield corresponding benefits many times the costs.

[26] DNA that has been created artificially when DNA from two or more sources is incorporated into a single recombinant molecule.

Development of a biotechnology initiative in Pakistan will be implemented in collaboration with the Pakistan Agricultural Research Council (PARC) and the National Agricultural Research Centre (NARC).

Founded in 1981, PARC is an autonomous apex body with a mandate to conduct, support, promote and coordinate research at the federal and provincial levels with a view to providing science-based solutions to agricultural development. PARC has seven major research establishments throughout the country, where it conducts research according to specific agro-ecological needs — including the National Agricultural Research Centre, Islamabad; the Southern Zone Agricultural Research Centre, Karachi; the Arid Zone Research Centre, Quetta; the National Tea Research Institute, Mansehra; the Sugar Crops Research Institute, Thatta; the Himalayan Agricultural Research Institute, Kaghan; and the Karakoram Agricultural Research Institute for Northern Areas, Gilgit.

NARC has 58 research labs, a national gene bank, and a technical staff of nearly 800 scientists and technicians, including over 100 PhD researchers. PARC conducts strategic research on emerging challenges in agriculture and national and provincial priorities. It conducts exploratory research on new commodities and fills the gaps in the provincial research agenda. It provides services to the provincial system in conservation and supply of germplasm, agricultural informatics, and human resource development. It also ensures collaboration and linkages with the provincial and international research system.

The design team met with PARC's chairman, who showed strong interest in working with USAID. PARC has also carried out discussions with USDA, but USAID can offer a much more effective link to the U.S. universities with experience in developing countries, including Cornell University, the University of Wisconsin and others.

Nearly all of Pakistan's biotechnology research and output is now in government institutions. Building Pakistan's biotechnology capability through Monsanto, which is in the process of negotiating entry, would be helpful to the private sector. An enhanced biotechnology capability would also help the Pakistan private-sector seed industry.

3.1.5.2. Expected Benefits

The biotechnology program is intended not only to increase productivity for several horticultural products and rice, but also to develop an advocacy group for legislation favorable to biotechnology applications. Pakistan is the only major exporter not using Bt cotton, although there is some illegal import and planting. Favorable legislation will greatly facilitate the massive expansion of Monsanto's Bt cotton in Pakistan. Expansion of Bt cotton production should increase yields by 30 percent. Given that the value of cotton production in Pakistan is $1.144 billion,[27] an addition to output of $344 million of gross income is expected — a once-and-for-all addition from this specific source. This benefit amount is 17 to 23 times higher than the $15-20 million that will be devoted to the biotechnology initiative.

[27] Converted from Rs. value as listed in Economic Survey of Pakistan.

3.2. Small-Scale Irrigation in the Barani Area

3.2.1. Rationale for Selection

3.2.1.1. Irrigation Activities Considered But Not Selected

In considering potential irrigation-related interventions, we have ruled out large-scale canal irrigated areas, including rehabilitation efforts in those areas, for several reasons:

- Severe problems of water allocation, pricing and management in those areas have resulted in low efficiency of water use
- Water management involving large-scale canals is an area where the World Bank and the Asian Development Bank have a strong comparative advantage in Pakistan relative to USAID.
- The World Bank and the Asian Development Bank have a history of supporting research in these areas, with broad agreement on what needs to be done.
- It is broadly agreed that the solution is to establish water user associations with power to allocate, tax and maintain physical infrastructure. However, the dominance of a few landlords and frequent collusion with irrigation officials have resulted in a poor operating record
- The World Bank and Asian Development Bank have long-standing negotiations to improve the current situation, including withholding substantial funds to enforce change — but so far with little impact. And there is no reason to believe that USAID participation will increase the chances for success.
- Large-scale canal irrigation offers no potential for scaling-up to the border areas and FATA
- Irrigation rehabilitation, a second potential area of intervention considered, is unlikely to be more successful without removing the current constraints to more-effective water user associations

3.2.1.2. The Case for Small-Scale Irrigation in the Barani Areas

About one-quarter of Pakistan's cultivable area remains outside the Indus canal system and suffers from chronically low agricultural productivity. In Punjab, about 20 percent of cultivable land lies in *barani* areas, where local rainfed farming systems and existing water sources can no longer support the growing local population.

Agriculture and livestock are the traditional sources of income in the *barani* areas. Improved income and reduced poverty for a large majority of small landholders and tenants will depend overwhelmingly on agriculture and livestock productivity and related growth in the non-farm sector.

The major constraint affecting the agricultural and livestock productivity of the *barani* area is a shortage of water. With no or very few secured water sources, farming becomes exclusively dependent on rainfall, which is irregular in both annual and seasonal amounts. The *barani* area is also especially prone to drought and consequent crop loss. Despite some improvements through the introduction of a few drought-resistant crop varieties, yields remain typically 40 to 50 percent lower than those in irrigated agriculture. Acute

susceptibility to prolonged drought is exacerbated by the absence of reliable surface water or groundwater sources.

Agriculture is the main source of income and of food supply in the *barani* areas. Fertilizer and agrochemicals are hardly used. Livestock feeds on crop residues and fodder on the farm premises. Significant gains in agriculture and livestock productivity and related economic growth in the *barani* areas can be achieved through water resources development, but little investment support has been made available to date. The best option appears to be the development of water storage by constructing small and mini dams.

To be most effective, the provision of infrastructure must be demand-driven and accompanied with the development of community-managed irrigation schemes. Development of community-managed irrigation schemes through water user associations has the highest chance of success in the *barani* areas. Since these areas are characterized by relatively even distribution of land, the dominance of a few large landowners will not be as overwhelming as in the canal areas. Such a feature is likely to improve farmers' participation and ownership and enhance the ability of the water users to develop remunerative farming systems and share the water equitably.

Since the recommended activities are small-scale in nature, organizing farmers would be easier; this is illustrated by the fact that many water user associations have already been successfully formed in these areas. Building on these achievements, the project should work with organized community groups to support the formation of legally autonomous farmer organizations and maximize positive impact on women. To achieve this objective, the USAID activity will need to build-in the necessary controls (such as rigorous conditions for release of funds) to ensure that the water user associations are performing as intended.

Another advantage of this scheme is that small-scale irrigation activities in the Punjab and Sindh *barani* areas can easily be scaled-up to have a major impact on the border areas, including FATA.

Small-scale irrigation will have a positive poverty reduction impact on income, employment opportunities, and food security. Agricultural intensification, particularly diversification to more labor-intensive high-value irrigated crops, will have a positive indirect impact on the poorest segments of the population by generating new job opportunities on a permanent basis. This result is all the more important in the *barani* areas, where poverty is more prevalent than in other locations.

3.2.2. Local Institutional Context

Agency for Barani Areas Development (ABAD)

ABAD was created in May 1978 with responsibility for the socioeconomic development of the Punjab Barani Tract, which is spread over 13 districts in Punjab with a total population of about 20 million.

In several meetings with the design team ABAD representatives demonstrated willingness and capacity to manage projects at the level recommended. Although other organizations are likely to assist in USAID's small-scale irrigation development effort (see below), ABAD

appears to be the most suitable organization for coordinating the overall initiative in Punjab.

Punjab, Sindh, and Northwest Frontier Irrigation Departments and Development Authorities

Irrigation development authorities (e. g., Punjab Irrigation Development Authority – PIDA) carry out all the functions of the irrigation wing of the irrigation departments (e. g., Punjab Irrigation Department – PID) as an autonomous body, with independent revenue collection and purchasing authority. They are responsible for policy formulation, legal enactment and supervision of the overall management of the irrigation and drainage system in the province.

Several discussions with a wide range of representatives from the irrigation departments and development authorities in the three provinces demonstrated a similar enthusiasm for partnering with USAID.

Baluchistan Irrigation Department/Irrigation Development Authority

The design team met with two representatives from the Baluchistan Irrigation Department in Islamabad, but could not travel to Baluchistan for more extensive discussions with other officials. It was apparent from these limited discussions in Islamabad that the interest in partnering with USAID was as strong as that shown by the other three provinces.

***National Rural Support Program* (NRSP)**

NRSP (see dairy section) has indicated interest in assisting USAID with the provision of water conservation structures in rainfed areas. Under the *Barani* Village Development Project, an IFAD-funded initiative, NRSP has assisted 3,000 communities in 6 *Tehsils* of Rawalpindi Division in completing the construction of 362 mini-dams in 5 years. Similarly, under the USDA-funded Pakistan Poverty Alleviation Fund, NRSP managed the implementation of about 40 rainwater harvesting structures and irrigation ponds in drought-hit desert areas of Bahawalpur, Southern Punjab, serving over 11,000 people. NRSP has also implemented community water resource management interventions in the coastal areas of Sindh province.

3.2.3. Expected Benefits

The core economic benefits of the new dams in the *barani* areas will come primarily from increased production in agriculture and livestock due to the shift from rainfed to irrigated agriculture. Irrigation will also stimulate diversification into higher-value crops. The substantial increase in crop residue and the increase in fodder production will support a larger livestock size and generate higher livestock productivity. Other benefits include domestic water supply, electricity supply, fuel wood, and fishing.

A study (Munawar Hussain et al) was conducted in 9 *tahsils* of Pothowar Plateau in Punjab to assess the impact of small-scale irrigation on agricultural production and poverty in marginal areas. A major conclusion of the study is that access to irrigation water through small-scale irrigation schemes should be promoted because it reduces poverty. Another study in the same areas (Mian 1995) concluded that development of

small-scale dams lead to an increase in crop intensity from 70 percent to 120 percent, a two-fold increase in crop yield and a 70 percent increase in net farm income[28].

Small-scale irrigation schemes are likely to have high internal rates of return[29] and benefit-cost ratios.[30] For instance, the internal rate of return and benefit-cost ratio for small dams in Rawalpindi are estimated at 27.44 percent and 4.31, respectively (Government of Pakistan 2005). The estimates for the Mohra Shena small dam are 24.19 percent and 3.82, respectively (Government of Pakistan 2008).

Table 3.1 lists the various benefits associated with small-dam construction. Based on results in the table and intensive interviews with government officials and knowledgeable professionals in Punjab, Sindh, NWFP and Baluchistan, the benefits of a small dam can be estimated at $500,000 per year.[31] Given that the costs of a small dam are about $7 million on average,[32] costs would be recovered by year 14. Since the average life expectancy of a small dam is well over 30 years, it is evident that those costs will be largely offset by the benefits accruing to farmers. This is all the more important because farmers in the *barani* areas in Pakistan are among the most vulnerable segments of the population.

[28] Studies in other developing countries with similar conditions reveal that access to reliable irrigation water enables farmers to adopt new technologies and intensify cultivation, leading to increased productivity, overall higher production, and greater returns from farming. For instance, findings in similar irrigation schemes in Ethiopia (Abonesh Tesfaye et al.) confirm that small-scale irrigation in arid areas contribute significantly to household food security because access to small-scale irrigation enables households to grow crops more than once a year; to ensure increased and stable production, income and consumption; and to improve their food security status. Carruthers et al. show more generally that irrigation development is the most cost-effective tool for poverty reduction than any other public development schemes in arid and semi-arid climates.

[29] The internal rate of return (IRR) is one of a number of financial ratios used to measure the efficiency of particular investment projects. The IRR is the return on capital employed. Sometimes referred to as economic rate of return, the IRR is the discount rate often used in capital budgeting that makes the net present value of all cash flow from a particular project equal to zero. The IRR may be used in investment appraisal to determine whether a prospective investment is viable. For instance, if the IRR is higher than the rate of interest at which the firm can borrow, the investment would be worth pursuing. In general, the higher a project's internal rate of return, the more desirable it is to undertake the project. As such, the IRR can be used to rank several prospective projects a firm is considering. Assuming all other factors are equal among the various projects, the project with the highest IRR would probably be considered the best and undertaken first.

[30] The benefit-cost ratio is used to evaluate the prospective costs and benefits generated by an investment in a capital project over its expected life. Such an evaluation includes the assessment of the risks of, and the sensitivity of the project's viability to, forecasting errors. It enables a judgment on whether to commit resources to the project. The benefit-cost ratio — net present value divided by initial outlay — is a measure of present value per dollar invested. The present value is calculated using a discount rate which you set to equal your bank's interest rate or the rate of return of some other alternative investment. In general, a project is accepted for investment if the benefit-cost ratio is greater than or equal to unity, and rejected otherwise.

[31] Calculations based on results in Table 3.1 and the following additional parameters associated with an average small dam: command area: 1,100 acres; irrigated farms: 120; beneficiary farm population: 960; additional beneficiaries from non-agricultural use of water supply: 6,000 people (3 villages/dam and 200 people/village on average).

[32] Costs include main dam, spillway and outlet structure, cement-lined channels leading to the farm fields, "command area" land acquisition, crop compensation, farmland development, field leveling, etc.

Table 3.1: Small-scale Irrigation (small dams): Expected Benefits

Type of Benefit	Assumptions/Parameters	Benefits ($ per beneficiary /year)
Agricultural crops	Agricultural crop benefits are derived from an increase in crop yields, cropping intensity from 60 percent to 120 percent, and the introduction of higher-value crops (mainly horticultural) due to the shift from *barani* to irrigated agriculture.	86
Livestock	In addition to increasing the livestock gross margin per animal (20 percent), the activity will lead to an increase in livestock numbers (25 percent) in the area.	110
Domestic water supply	• Supply of domestic water will reduce by two hours per day it takes one person in each household to collect water (estimated benefit: $19.75/per beneficiary). • The improved water supply is estimated to half the average cost per household of costs (including transport, doctors' fees, medicine and laboratory work) associated with waterborne diseases ($1.625/beneficiary) and prevent the loss of 10 days of semi-skilled labor per year per connected households ($4.375/beneficiary).	24
Fishing	$742 per ha of water surface area	10
Watershed	The benefits of forestry activities within the watershed area are based on an estimated 50 donkey loads of fuel wood per year per ha.	1.8
Electricity generation	—	1.3
Employment opportunities	Generation of new employment opportunities due to agricultural intensification, particularly diversification to more labor-intensive higher-value irrigated crops (two new workers per ha per year).	131
Total		364

Note: Estimated benefits do not include other benefits such as flood control (which eliminates flash flooding, erosion damage and public safety threat) and groundwater recharge.

Sources: Design team calculations using data and assumptions in ADB 2008. ADB data are for an intervention covering 2,024 ha, 1345 households or 10,760 beneficiaries.

The benefit-cost advantage is even higher for mini dams.[33] The benefits of a mini dam are estimated at $14,000 per year.[34] Given that the costs of a mini dam are about $19,000 on average, they would be recovered in less than two years.

[33] "Mini" dams are an emergent very successful irrigation method utilized in rain/snow fed barani areas of northern Punjab. The design is based on a proven method used to store year round rain and flood water that otherwise would not be available during the drought season and pass downstream and escape unutilized.

[34] Calculations based on the following parameters associated with an average mini dam: command area: 35 acres; irrigated farms: 5; beneficiary farm population: 40; total benefits/person: $351 ($364 for small dams minus fishing, electricity and watershed benefits, as per the table above).

If we assume a total project expenditure on small-scale irrigation of $100 million (say, $70 million for small dams and $30 million for mini dams),[35] then we obtain the following results:

- Total benefits per year: $27 million
- Total area covered: 66,000 acres
- Total number beneficiaries: 73,000

An important additional benefit is that irrigation works are highly labor intensive in installation. Since 40 percent of dam construction costs are allocated to labor, dam construction yields immediate and substantial short-term increments in employment. It is estimated that for each $100 million spent on small- and mini-dam construction, over 13 million labor days or 50,000 labor years (full-time jobs for a year) will be created. Construction of a small dam would generate over 900,000 labor days or nearly 3,500 labor years, for an average cost of about $7 million. Similarly, a mini dam would generate 2,400 labor days or about 9 labor years, for an average cost of $19,000.

[35] In practice, the topography and related factors determine whether small or mini dams are appropriate for a given area. Mini dams are generally constructed further up the narrower watersheds where small dams are too big and not feasible.

CHAPTER 4: PROJECT MANAGEMENT

4.1. Three Subprojects

As depicted in the figure below, the Pakistan Food and Agriculture project is divided into three separate but closely interconnected subprojects: the Integrated Agricultural Growth Project, the Agricultural Policy Research Institute, and the Small Scale Irrigation Project.

4.1.1. The Integrated Agricultural Growth Project

The Integrated Agricultural Growth Project has four components: biotechnology, dairy, horticulture and wheat — reflecting the three commodities selected for emphasis due to their substantial expected contributions to agricultural sector growth, rural income, and employment in Pakistan over the life of the project.

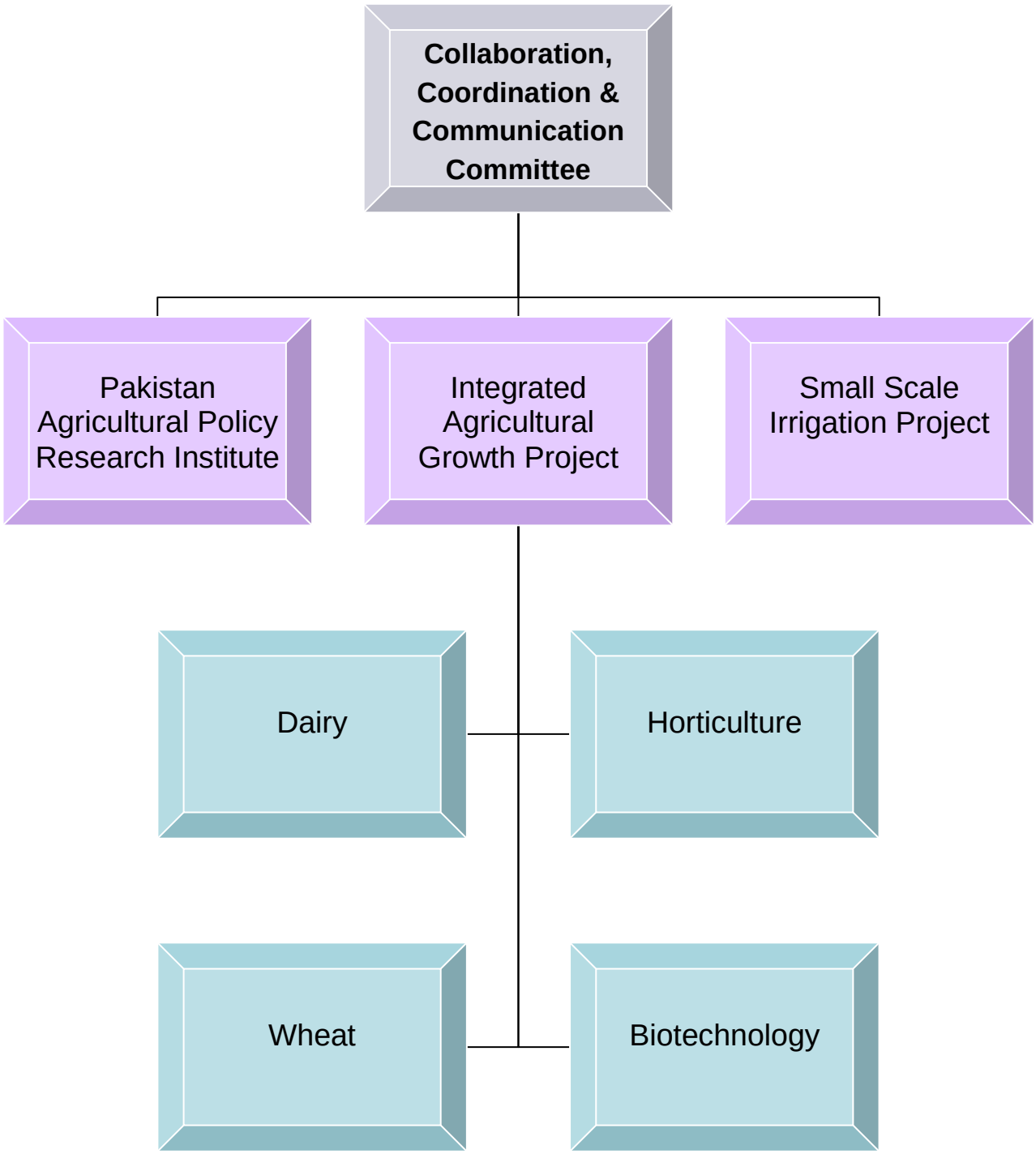
Each component within the Integrated Agricultural Growth Project is based on a wide range of key interventions along the value chain. For wheat, two critical activities will be emphasized: applied research and extension, and biotechnology. Equal attention will be given to applied research and extension for dairy and horticulture, but more extensive support throughout the value chain will be provided — particularly in the areas of product marketing and value addition.

It is important to note that applied research and extension is not a separate component of the Integrated Agricultural Growth Project, but a key activity across all three of its components.

4.1.2. The Pakistan Agricultural Policy Research Institute

The Pakistan Agricultural Policy Research Institute consists of six divisions: (1) Agricultural Strategy and Priorities, (2) Trade, (3) Production, (4) Consumption and Nutrition, (5) Marketing and Agribusiness, and (6) Monitoring and Evaluation.

Structure of the Pakistan Food and Agriculture Project



4.1.3. The Small Scale Irrigation Project

The Small Scale Irrigation Project has two interrelated components: (1) a public-works component to build small- and mini-dams and associated rural-road infrastructure in the *barani* areas to improve water availability in the dry season by spreading the flow of water over the year; and (2) technical assistance activities to apply the project's agricultural research packages for wheat, dairy, and horticulture subsectors, and to conduct value-chain analysis and intervention design to match approaches and cropping patterns with conditions in those areas.

4.2. Interconnectedness of the Three Subprojects

The close relationship between the Small Scale Irrigation Project and the Integrated Agricultural Growth Project is self-evident in that the technical assistance activities of the Small Scale Irrigation Project represent a central part of the Integrated Agricultural Growth Project. Similarly, the production division of the Pakistan Agricultural Policy Research Institute will be needed to analyze alternative approaches, optimal cropping patterns, water user association strengthening, and crop marketing strategies.

Also, since agricultural policies, such as water-management, seed, price and trade policies, cut across subprojects, the Pakistan Agricultural Policy Research Institute will support the two projects equally. Its monitoring and evaluation division will play a critical role in this support. The monitoring and evaluation division was added to the five other divisions by design, with a view to improving decision making and enhancing project performance through identification and dissemination of best practices and lessons learned within each subproject and across subprojects. The monitoring and evaluation function will be all the more important due to the multiplicity of approaches and community-driven initiatives that will be used, and the need for rapid management reaction.

4.3. Collaboration, Coordination and Communication among the Three Subprojects

The interconnectedness among subprojects suggests that a high degree of collaboration, coordination and communication among subprojects will be required. This necessary function will be carried out through a collaboration, coordination and communication committee (CCCC). Chaired by the chief of party (COP) of the Integrated Agricultural Growth Project, the CCCC will include the COP of each of the three subprojects. It will meet quarterly and more frequently as needed. Those meetings will be included as an integral part of each subproject work plan, and their proceedings will be made available to key members of subproject staff.

The coordination and collaboration among the three subprojects will be strengthened by designing and implementing a comprehensive, on-going communications and knowledge sharing plan. This task could be led by the Agricultural Policy Research Institute. Some of the opportunities for enhanced communications among the subprojects might include:

- Designing and facilitating annual meetings of all staff members from all three subprojects to share accomplishments and develop a coordinated work plan for the following year
- Periodic briefings for GOP and USAID on the status of the overall project by the three COPs, to review how they are working together and highlight project synergy
- Forming communities of practice made up of individuals from the three subprojects
- Scheduling periodic workshops and brownbag discussions for project staff and counterparts to share current work and identify opportunities for collaboration. These interactive workshops and similar gatherings would help strengthen the communities of practice that have been formed
- Developing an on-line library where all project documents are available to all team members, regardless of subproject affiliation
- Implementing an annual demonstration day that brings together stakeholders to visit specific project activity sites, such as demonstration plots that show the impact of certain irrigation techniques on horticulture crops

CHAPTER 5: CONCLUSIONS

This paper has argued that promoting efficient and sustainable agricultural growth is a necessary condition for rural growth, poverty reduction and social stability in Pakistan. Using a comprehensive and multifaceted approach to agricultural development, the paper outlined an agricultural development strategy based on a limited set of strategically selected, highly focused and well integrated interventions. Those interventions have been designed to raise income for small farmers and increase employment opportunities in rural areas.

Pakistan has the resource base for achieving a 5 percent growth rate, a full 2 percent higher than the current 3 percent. The difference between a 3 percent and 5 percent growth rate in agriculture represents the difference between (a) a significant increase in employment and substantial downward trend in poverty and (b) stagnation in employment and wage rates, and concomitant stagnation in poverty levels. Such a difference would have direct consequences on the welfare of millions of Pakistanis, with critical implications on national and regional stability. However, this result cannot be achieved without acceleration of each of the three major agricultural commodity groups (dairy, horticulture and wheat), which comprise three-quarters of the increase in agricultural production under a strategy designed to reach the 5 percent growth-rate target.

Constraints to, and opportunities for, growth in the three subsectors were identified using a value chain approach extending from farm to market. Applied research and extension have been emphasized to reflect the consensus that, due to severe land and water constraints, agricultural growth in Pakistan will not materialize without substantial increases in productivity. Creation of an agricultural policy research institute is suggested due to the current lack of high-quality agricultural policy analysis to guide decision-making. Small-scale irrigation systems to stimulate rural growth and promote employment opportunities in the *barani* areas are also recommended.

There is very little room for USAID intervention regarding land reform at this time, for three reasons. First, land reform in Pakistan has neither political support nor the backing of religious authorities. Given these severe institutional constraints to equitable land redistribution, any USAID intervention in this area will not be politically feasible in the foreseeable future. Second, the major interventions recommended to USAID by the project design team emphasize contexts which are not substantially constrained by existing land tenure issues. This is particularly true of the recommendations associated with the dairy and horticulture subsectors. Third, implementing a complex and controversial landholding policy initiative under the project would be a distraction from the project's specific, highly-focused agenda.

The strategy described in this paper has both a short- and longer-term impact. The short-term impact on poverty and employment will be a direct result of a public-works initiative largely based on small-scale irrigation, associated road building, and rehabilitation of irrigation channels in selected areas. Since 40 percent of dam construction costs are allocated to labor, dam construction yields immediate and substantial increments in employment. It is estimated that for each $100 million spent on small- and mini-dam construction, over 13 million labor days or 50,000 labor years (full-time jobs for a year) will be created.

The irrigation departments and related authorities are ready to go, with engineering plans in hand. It is critical, however, that attention be given to the long-term impact of project activities. Our long-term strategy involves enforceable requirements that well-operating water-user associations are in place to guarantee payment for maintenance costs, and to ensure equitable and rational distribution of water.

The comprehensive applied research and extension projects in dairy, horticulture and wheat production can have substantial impact on production, income and employment starting with the end of the first year of implementation — with that impact increasing over the following four years. Results in the first year may be possible because many research-based packages are on the shelf or close to fruition.

It is estimated that with a 5 percent agricultural growth rate and 8 percent in the urban sector, employment will grow by annual increments of three million jobs per year — one million more than labor force growth. Fully 80 percent of that employment growth would be generated by agriculture and its employment multipliers to the rural non-farm sector. The impact on poverty will come most rapidly from the dairy sector for two reasons. First, ongoing technical assistance models can rapidly expand. Second, dairy production activities are carried out disproportionately by some of the lowest-income groups, particularly women. The upstream aspects of research, particularly biotechnology, will lay the groundwork for the short-term impact to continue well into the life of the project and the more distant future.

Similarly, the agricultural policy research institute could have an impact on production, incomes and poverty reduction within a year of establishment, as it builds upon existing research to remove major policy constraints to a more vigorous agricultural sector. The long-term impact of the agricultural policy research institute is likely to be considerable as its research, dissemination and advocacy initiatives expand into other policy areas related to agricultural strategy and priorities, trade, production, consumption and nutrition, marketing and agribusiness development, and monitoring and evaluation.

The expected benefits from project interventions in each sector are substantial. For instance, in dairy it is expected that:

- The incomes of 1.5 million participating women will increase significantly on an annual-compounding basis
- On average, incomes of participating women would be raised by $250 per year i.e., that much is added each year, cumulatively
- Total annual increase in income would be $375 million i.e., that much would be added each year, cumulatively
- Per capita milk consumption would rise by about 2 liters per year with a major impact on nutrition, also compounded annually

Similarly, expected benefits in the horticultural sector are that:

- 300,000 participating farmers would have incomes significantly increased on an annual-compounding basis
- Incomes of participating farmers would be raised by $89 per year on average i.e., that much is added each year, cumulatively

- Total annual increase in income would be $27 million i.e., that much will be added each year, cumulatively
- Average per capita horticultural consumption would rise throughout the country, even among the very low-income horticultural farmers, with a major impact on nutrition — a benefit also compounded annually

The Pakistan Agriculture and Food Project should be viewed in the broader context of both USAID's economic growth portfolio and USAID/Pakistan's overall development effort. As detailed in this paper, accelerated agricultural growth is a necessary condition for a vibrant rural economy, for a substantial reduction in poverty, and for improving the country's stability. For this reason, the Pakistan Agriculture and Food Project should be considered as the central pillar of the Empower Pakistan portfolio and USAID/Pakistan's overall development program.

Because agricultural growth is a necessary, but not sufficient, condition for rapid reduction in rural poverty, USAID support through the other Empower Pakistan projects will be instrumental in complementing the agricultural growth interventions outlined in this paper. Two of those initiatives merit particular mention: private sector development under the Empower Pakistan: Firms (EPF) program, and the Community Rehabilitation and Infrastructure Support Program.

Since the ultimate objective of any poverty reduction strategy is to increase the welfare of the poor, USAID/Pakistan's health, education and governance programs to promote human capital and social mobilization among the poor will provide additional resources for a well-integrated strategy that will ensure substantial reduction in rural poverty and enhanced social stability.

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