

CREB Working Paper No. 02-08

Agricultural Growth in Irrigated Punjab: Some Issues and Policies

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Preface

Centre for Research in Economics and Business (CREB) was established in 2007 to conduct policy-oriented research with a rigorous academic perspective on key development issues facing Pakistan. In addition the Centre (i) facilitates and coordinates research by the faculty at the Lahore School of Economics, (ii) hosts visiting international scholars undertaking research on Pakistan and (iii) administers the postgraduate programme leading to the M Phil and PhD Degree at the Lahore School.

An important goal of the Centre is to promote public debate on policy issues through conferences, seminars and publications. In this connection, the Centre organizes the Lahore School's Annual Conference on the Management of the Pakistan Economy. The proceedings of which are published in a special issue of the Lahore Journal of Economics.

The CREB Working Paper Series has been started to bring to a wider audience, the research being done at the Centre. It is hoped that these Papers will promote discussion on the subject and contribute to a better understanding of economic and business processes and development issues in Pakistan. Any comments and feedback on these Papers will be appreciated.

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Abbreviations and Acronyms

APMC	Agricultural Produce Marketing Committee
AWB	Area Water Board
FAO	Food and Agriculture Organization
FFS	Farmer Field School
FO	Farmers Organisation
GDP	Gross Domestic Product
ha	Hectare
IPD	Irrigation and Power Department
IPM	Integrated Pest Management
LCCE	Lower Chenab Canal East
LDDB	Livestock and Dairy Development Board
MC	Management Committee
mt	Metric ton
NSF	Non-Solid Fat
O&M	Operations and Maintenance
PARB	Pakistan Agricultural Research Board
PARC	Pakistan Agricultural Research Council
PIDA	Provincial Irrigation and Drainage Authority
PISPR	Punjab Irrigation Sector Reforms Programme
PSC	Punjab Seed Corporation
R&D	Research and Development
RSPs	Rural Support Programmes
TFP	Total Factor Productivity
UHT	Ultra High Temperature
WTO	World Trade Organisation

Abstract

This paper focuses on some of the major policy issues for accelerating a sustainable and equitable agricultural growth process in Punjab in the next five to ten years. There are numerous policy issues given the multiple and competing interests of the many stakeholders. The policy issues analysed in this paper are limited to the productivity and quality of land and water resources; production and distribution of seeds; transfer and adoption of productivity-enhancing and profitable technology that protects the environment and quality of the resource base; and market structures (supply chains) and government regulations for markets of fruits and vegetables and livestock and products. Based on the analysis, the paper concludes with several suggestions for further research and changes in public policy.

Keywords: Policy Issues, Stakeholders, Market Structures, Public Policy.

Agricultural Growth in Irrigated Punjab: Some Issues and Policies

1. Introduction

2008 is an important year for agriculture: it is in the headlines all around the world.¹ The immediate crisis of food shortages and price spikes will perhaps be over soon—maybe not too soon and not everywhere. The challenge in the medium to long term in countries like Pakistan is that the agriculture sector must grow on a sustainable basis to make its desired contribution to the national economy and the well-being of small farmers, landless livestock holders and labourers, and consumers. Also agricultural growth is a necessary, but not sufficient, condition for rapid reduction in rural poverty (Malik 2005; World Bank 2007).²

Punjab dominates the national economy and the agriculture sector in several ways: it contributes nearly 60 per cent of Pakistan's GDP and 57 per cent of the agriculture value-added. In agriculture, the province's share in the crop value-added is about 70 per cent (73 and 65 per cent for major and minor crops, respectively) and 45 per cent in the value-added of livestock. Over 70 per cent of the crop area and three-quarters of the irrigated area of the country are in Punjab. Its share in crop output ranges from 57 per cent in rice to 79 per cent in cotton, 66 per cent in vegetables and 79 and 92 per cent in mango and citrus fruits, respectively; and in livestock products the share is nearly two-thirds in milk output, one-half in beef, one-third in mutton, and three-quarters in poultry meat.

¹ In this paper, agriculture means crops and livestock only. The *2008 World Development Report*, subtitled 'agriculture for development', is devoted entirely to the challenges and opportunities for agriculture as the leading sector for growth, equity and poverty reduction. It is just over twenty years that the last major review of the agriculture sector in Pakistan was published by the National Commission on Agriculture.

² The extent to which the non-agricultural households benefit from growth in agriculture depends largely on the linkage effects. According to the World Bank (2007), these effects have far more limited impact on GDP and rural poverty now than they did in the past because of the reduced contribution of agriculture to GDP. Additional stimulus would be required for the rural non-farm economy to grow well and transfer the gains to the rural poor not dependent on agriculture. The same World Bank study has revealed that agricultural growth benefits both small landowning farmers and landless tenants, though a proportionately larger gain is appropriated by the large landowning farmers because of the highly skewed distribution of land and access to capital. But for livestock products, the gains are significant and more evenly distributed because of the relatively diffused distribution of livestock ownership.

It should be emphasised that water from the public canals and private tube-wells is the lifeline of agriculture in Punjab, although the rainfed (*barani*) districts of the province contribute quite significantly to grains and livestock (large and small ruminants) products. The transformation (increased efficiency, diversification, and profitability) of agriculture in the irrigated districts of central, southern and south-western Punjab seems to hold the key to the provincial and national economies in terms of reduction in rural poverty, increased farm incomes, greater 'food security', expanded employment for labour, increased export earnings, and additional government revenue.³

1.1. Challenges and Issues

This paper focuses on some of the major policy issues for accelerating a sustainable and equitable agricultural growth process in Punjab in the next five to ten years. The challenges are well known:

- meet the changing consumer preferences and dietary habits induced by income growth and urbanisation;
- conserve land and water resources in the face of the not-too-certain but potentially serious consequences of climate change;
- absorb the rapidly rising cost of inputs (particularly energy) and maintain farm profitability;
- involve small farmers and livestock holders in a diversified and commercial agriculture;
- open new investment opportunities in the rural non-farm economy to provide jobs to the landless rural labour; and
- integrate into the global (and increasingly competitive) markets for food and industrial raw material.

³ The notion of 'food security' is best used for individuals and not countries. At the individual level, it implies a level of food consumption that provides adequate nutrition to the individual, according to age, gender, and work status, to perform normal functions. Food insecurity implies lack of means or entitlement to maintain this level of consumption. This can be caused by a variety of factors, including natural disasters, wars, and persistent or transient poverty. The important point is that increased food production is only one aspect of ensuring food security since there is good evidence that the level of overall production or availability of food may or may not have a significant impact on food security particularly for the poor populations. In the context of countries, neither low income per capita nor dependence on imported food is by itself an indicator of food insecurity: some modest importers of food can be more insecure than larger exporters because they cannot afford greater imports.

These challenges also offer new opportunities and incentives to make the agriculture sector a vibrant partner, if not leader, of the provincial and national economies. There are numerous policy issues given the multiple and competing interests of the many stakeholders, including small and large landowners and livestock holders, landless tenants and labourers, private market intermediaries (traders, processors and manufacturers), consumers, not-for-profit private organisations, and the public sector departments and agencies. However, the policy issues selected for analysis in this paper are far more limited. They include the following.

1. Productivity and quality of land and water resources
2. Production and distribution of seeds
3. Transfer and adoption of productivity-enhancing and profitable technology—biotechnology in particular since it reduces dependence on input-intensive technology and protects the environment and quality of the resource base
4. Market structures (supply chains) and government regulations for markets of fruits and vegetables and livestock and products

1.2. Framework for Analysis

The analysis is premised on three important propositions. First, a ‘farming systems’ approach should be used in which crops and livestock are viewed as two interdependent parts of the production regime adapted to the changing resource endowment and markets.⁴ Second, small farmers (landowners and tenants) and livestock holders are the key players—small-scale agriculture supports the livelihoods of a majority of the rural poor—whose integration in the rapidly expanding commercialised agriculture sector is an essential part of the transformation process. Needless to add, the economic survival of small farmers depends on their livestock and wage labour. Third, the agencies of state (government) should be in the business of protecting property rights that are well defined; investing in public goods (infrastructure and support services); regulating the

⁴ The concept of farming systems is interpreted in a variety of ways. A generally accepted definition of a farming system refers to ‘a population of individual farm systems that have broadly similar resource bases, enterprise patterns, household livelihoods and constraints, and for which similar development strategies and interventions would be appropriate.’ (Dixon and Gulliver, 2001, p.9).

marketplace for quality and safety for producers and consumers; maintaining an efficient and fair regime of taxation; and providing support (safety net) to the disadvantaged and vulnerable individuals or groups by income, gender, age, or skills. The business of state is not to throttle private initiative and innovation by myriad controls and distort the signals for efficient production and distribution.

It is widely recognised that the average yield levels of crops and livestock in Punjab are far lower than what can be achieved, and the disposal of what is produced on the farm is through an agriculture marketing system which tends to penalise both producers and consumers. In the context of designing and implementing policies for an inclusive and sustainable process of agricultural growth in Punjab, it seems fair to take into account at least five conditions.

1. It is essential that the national and provincial research systems convert and adapt to the local conditions the best scientific knowledge that exists nationally and internationally.
2. The stock of tested knowledge and technology should be transferred to farmers and holders of livestock in packages that raise the efficiency levels of their resources and farm profits – profitability of new technology is the ultimate test of how well the existing knowledge has been adapted to the conditions and resource constraints of ordinary farmers. Needless to add, farmers, no matter how small or resource-constrained, are quite receptive to profitable technology no matter where and how they happen to find it.
3. Farmers should have an environment in which their rights to property and resources are well protected; they have fair access to well-regulated and competitive markets for buying farm inputs and services and selling their products; they are supported by the state—three levels of government and other agencies—with (a) good quality of physical and social infrastructure (public goods) and (b) macroeconomic policies and regulatory regimes that are well-designed for proper (non-distortionary) incentives and fairly enforced to maintain confidence.
4. Since a vast majority of farmers and livestock holders are small and they contribute a significantly large proportion of food and other agricultural products in the province, they should be provided fair

access to resources and a level playing field for participation in the marketplace. Their integration in the rapidly changing commercial environment—there are good participatory models available for this purpose—will contribute not only to the well-being of these groups but also to other economic and social goals at the local, provincial and national level.

5. Given the concern with issues of environmental degradation, food safety and health the world over and the more open and competitive international markets, it is absolutely essential to (i) wean the farm producers away from dependence on input-intensive technology and wasteful management practices and (ii) put in place and enforce rules and regulations that maintain proper incentives for private initiative, innovation and investment, reduce space for rent-seeking and penalise perverse behaviour (pollution and free riding). Price distorting and inequitable (generalised) subsidies, which drain public resources with high opportunity cost, are not part of the emerging regime for international trade in agricultural goods. Government policy must shift from providing subsidies on farm inputs to investment and support for research and extension services, market infrastructure and information, electrification, and value-addition in crop and livestock products.

These conditions define the framework in which the policy issues identified earlier are analysed: quality and productivity of land and water resources; production and distribution of seeds; transfer and adoption of economically efficient (profitable) technology and management practices; and market structures (supply chains) and regulations. The purpose of the analysis is to identify some of the major problems and constraints and highlight the possibilities for change.

Three important notes of caution should be added here. First, on some issues the existing information is quite good but on others it is either incomplete or of uncertain quality. Some 'facts' (data) or propositions will have to be tested (researched) and validated to arrive at reasonable conclusions about change. Almost all of the statistics on economic social indicators are produced by one or another government agency at the federal or provincial level. These agencies have almost unchallenged (if not unchallengeable) control of the information and data they possess. An associated and necessary aspect is the secrecy with which the monopolist protects the numbers (data) with impunity. In fact, it is

secrecy that empowers the holders of information. Another reason is the dubious competence and lack of rigour with which the data are gathered, processed and disseminated.⁵ Second, it is not a good idea to make drastic or large-scale changes of which the consequences are not well known or well tested on a small scale: do not throw the baby out with the bathwater!⁶ But this is not a signal to do nothing since the cost of doing nothing or procrastinating can be enormous if not disastrous. It would suffice to say that the power of vested interests (and special interest groups) to resist change should not be underestimated, especially in a predominantly patron-client social system. Finally, the issues discussed in this paper are limited in number and on each issue the focus is on only those aspects that are considered worth exploring for further research and action by policymakers and their agents.

2. Structure and Performance of Agriculture

The landscape of Punjab is quite diverse in geography, land and water resources, farming systems, state of physical and social infrastructure, extent of urbanisation, and state of poverty. With regard to the production of crops and livestock, Punjab is generally divided into five 'agro-climatic' zones: *barani* districts in the north producing grains and oilseeds with plenty of small and large ruminants; irrigated upper central districts with a rice-wheat rotation and livestock; irrigated lower central districts with mixed cropping and livestock farming; irrigated southern districts dominated by a cotton-wheat rotation and sugarcane; and the south-western and western districts with low-intensity agriculture and plenty of small and large ruminants. These are no more than the broad contours of an almost kaleidoscopic pattern of crops and livestock, especially with the recent growth of commercial and peri-urban pockets of agriculture and related industry in the central districts of the province. The northern (*barani*) districts have the lowest incidence of rural poverty thanks to the incomes earned from outside the rural economy through service, etc. The highest incidence and severity of rural poverty are in the cotton-wheat and low-intensity districts in the south and south-western parts: the ten 'poorest' districts are in these parts of Punjab.⁷

⁵ The issue of access to data and its quality has been discussed for several years. In the context of the data on value-added by crops and livestock, see Malik (2005). Also see Khan (2008).

⁶ The limits of 'good governance' are quite narrow and should be appreciated in any discussion of public policy and its administration. See Rodrik (2008).

⁷ See Government of Punjab (2004) and Jamal (2007).

The structure of rural households, especially those engaged in agriculture, their access to and use of agricultural land are among the leading factors to be taken into account in any credible analysis or explanation of agriculture in Punjab. In this regard the relevant data and information are reported in the decennial agriculture census. Households are divided into 'agricultural' and 'non-agricultural' categories and the former are subdivided into 'farm' and 'livestock' households. The data from the 1972 and 2000 censuses of agriculture show some interesting features (Table 1). The share of agricultural households in the total fell from 68 to 55 per cent. Among farm households the share of households with small holdings rose from 62 to 85 per cent, whereas the proportion of households with large and medium holdings fell from four to one per cent for the former and 34 to 13 per cent for the latter. This means that farming in Punjab depends largely on households with very small holdings. Another important feature is that the proportion of livestock holders has stayed at about one-third of all agricultural households.

Table 1: Agricultural and Non-agricultural Households in Punjab, 1972 and 2000

Households	1972		2000	
	Number (000)	Per cent	Number (000)	Per cent
Agricultural Households	3780	68.0	5792	54.5
Per cent Farm Households	68.0		67.1	
Per cent Large Holdings	4		1	
Per cent Medium Holdings	34		13	
Per cent Small Holdings	62		85	
Per cent Marginal Holdings	24		56	
Per cent Livestock Households	32.0		32.9	
Non-Agricultural Households	1780	32.0	4838	45.5

Source: Pakistan Agriculture Census Reports, 1972 and 2000.

The ownership of and access to land has also undergone significant changes. In terms of ownership, the number of 'ownership' holdings has increased by 68 per cent with little change in the reported area (Table 2). But the share of large (over 20 ha) and medium-size (over 5 to 20 ha) holdings fell from 25 to 12 per cent. Eighty eight per cent of holdings are small (up to 5 ha) and of these about 70 per cent are marginal holdings (up to 2 ha). Also, the share of large and medium-size holdings in the area fell from 73 to 55 per cent and the share of marginal holdings nearly doubled to 17 per cent. The average holding size is about 2.8 ha.

There has also been a significant shift to 'self-cultivation': 89 per cent of holdings and 80 per cent of the area are reportedly operated by landowners themselves (Table 3).⁸ Owners of small and medium holdings operate more of their area than do large owners. It is clear that dependence on tenants has declined quite a bit.

Table 2: Distribution of Ownership Holdings in Punjab, 1972 and 2000

Year	Per cent Share in Number				Area (000 ha)	Per cent Share in Area				Average Size (ha)				
	Number (000)	L	Md	S		Mg	L	Md	S	Mg	All	L	Md	S
1972	2299	4	21	76	46	11093	36	37	27	9	4.8	44.6	8.7	1.7
2000	3866	1	11	88	61	10906	22	33	45	17	2.8	43.5	8.3	1.5

Source: See Table 1.

Note: The size of holdings are: L = large; Md = medium; S = small; Mg = marginal.

Table 3: Self-Operated Holdings and Area in Punjab, 1972 and 2000

Year	Per cent Share of Self-Operated Holdings				Per cent Share of Self-Operated Area			
	All	Large	Medium	Small	All	Large	Medium	Small
1972	74	81	79	72	62	50	66	72
2000	89	87	90	90	80	57	83	89

Source: See Table 1.

Table 4: Distribution of Farms in Punjab, 1972 and 2000

Year	Per cent Share in Number				Area (000 ha)	Per cent Share in Area			Average Size (ha)			
	Number (000)	L	Md	S		L	Md	S	All	L	Md	S
1972	2375	3	32	65	12558	20	50	30	5.3	35.7	8.3	2.4
2000	3864	1	14	85	11235	14	39	47	2.9	34.2	8.3	1.6

Source: See Table 1.

The census data on 'operational' holdings (farms) tend to reinforce the preceding trends. Eighty-five per cent of farms are small and account for nearly one-half of the farm area (Table 4). The average size of farm fell from over 5 to less than 3 ha, because of the decline in share of large

⁸ There could be three explanations for this change. First, this may reflect the sub-division of holdings through inheritance. Second, owners may have found the transaction and other costs of tenancy too high. Finally, the owners of medium and large holdings may have under-reported the incidence of tenancy to protect themselves from a land reform programme.

and medium farms and reduced size of small farms. Two other important changes should be noted: the tenant-operated area across all farm size—less than one-quarter of the farm area is given to tenants—has fallen and so has the extent of sharecropping on farms—less than two-thirds of the tenant-operated area or 17 per cent of the total farm area is sharecropped (Table 5).⁹ It may not be out of place to mention that, contrary to the common impression, the extent of land fragmentation in Punjab has gone down from 62 to 37 per cent of farms and 74 to 54 per cent of the farm area; small farms have experienced the largest contraction (from 56 to 33 per cent of farms and 63 to 41 per cent in farm area). This positive change may reflect the combined effect of market forces (i.e. private transfer of land parcels) and the land consolidation efforts in the province. Finally, while there was little change in the intensity of land use, except on large farms, the cropping intensity increased by about one-half from 112 to 154 per cent. Cropping intensity rises inversely with farm size and the biggest gain has been on small farms (from 120 to 163 per cent). Increased cropping intensity is a reflection of increased water supply—irrigation intensity rose from 82 to 113 per cent—and perhaps better management in response to the forces of market and public policy.

⁹The census data on ownership holdings and operational holdings in Punjab tend to show that ownership of land is more concentrated than access to land through tenancy. While the concentration of landownership has not changed the access to land seems to have fallen. The numbers for the Gini coefficient computed from the census data are (Khan, 2006):

	<u>1972</u>	<u>1982</u>	<u>1990</u>	<u>2000</u>
Ownership holdings	0.61	0.62	0.60	0.61
Operational holdings	0.46	0.51	0.54	0.57

The ownership data from land revenue records show that the landownership concentration fell from 0.62 in 1950-55 to 0.49 in 1981 (Khan, 2006). Similar data are not available for more recent years.

Table 5: Distribution of Farm Area by Tenancy in Punjab, 1972 and 2000

Year	Per cent Owner-operated Area				Per cent Tenant-operated Area				Per cent Sharecropped Area in Tenant-operated Area			
	All	L	Md	S	All	L	Md	S	All	L	Md	S
1972	52	71	47	51	48	29	53	49	81	64	82	85
2000	77	79	73	80	23	21	27	20	65	62	64	66

Source: See Table 1.

The evidence on growth in the last five years (Table 6) is that Punjab outperformed the national economy in at least two important respects: the provincial Gross Domestic Product (GDP) grew annually at 7.7 per cent and the national GDP at 7.0 per cent and in each year the growth rate in Punjab was higher. Similarly, the agriculture value-added in Punjab grew annually at 5.0 per cent, but the national rate was 3.9 per cent.¹⁰ But the growth rate of agriculture was volatile: it fell to 0.9 and 0.4 per cent in 2003-04 and 2005-06, respectively, reflecting the impact of inclement weather and pest attacks on major crops.

Table 6: Annual Growth Rates of GDP and Agriculture in Pakistan and Punjab, 2002-07

Indicator	(Per cent)					
	2002-03	2003-04	2004-05	2005-06	2006-07	Average
GDP (Pakistan)	4.7	7.5	9.0	6.6	7.0	7.0
GDP (Punjab)	5.8	8.0	9.4	7.4	7.8	7.7
Agriculture (Pakistan)	4.3	2.3	6.5	1.6	5.0	3.9
Agriculture (Punjab)	7.1	0.9	10.4	0.4	6.3	5.0

Source: *Punjab Economic Report 2007* and *Pakistan Economic Survey 2006-07*.

In Punjab, the composition of agriculture value-added by source has changed quite significantly: the share of crops fell from 64 per cent in 1999-2000 to 60 per cent in 2006-07 and that of livestock rose from 35 to 39 per cent (Table 7). In the same period, the land and water base of agriculture in Punjab changed as well. The crop area increased by nearly 9 per cent, but the irrigated area rose by 13 per cent: the multiple-crop area grew from 20 to 43 per cent and the single-crop area

¹⁰ According to the estimates for 2007-08, given in Government of Pakistan (2008), Pakistan's GDP grew at 5.8 per cent and the agriculture sector by only 1.5 per cent. The average annual growth rate for agriculture works out to 3.5 per cent in the last six years (2002-08)

shrank from 69 to 49 per cent. The share of irrigated area in the cultivated area rose from 107 to 116 per cent and in crop area from 85 to 88 per cent. Of the two main sources of irrigation water, canals and tube-wells together account for 53 per cent, followed by 24 per cent from canals only and 20 per cent by tube-wells only.

Table 7: Share of Sub-sectors in Agriculture Value-added in Punjab, 1999-00, and 2002-07

Sub-Sector	(Per cent)					
	1999-2000	2002-03	2003-04	2004-05	2005-06	2006-07
Crops	64.1	58.9	58.4	61.1	59.1	59.9
Major Crops	48.5	44.6	44.5	48.1	45.6	46.5
Minor Crops	15.6	14.3	13.9	13.0	13.5	13.4
Livestock	34.8	39.8	40.3	37.6	39.7	39.1
Crops & Livestock	98.9	98.7	99.7	98.7	98.8	99.0
Others	1.1	1.3	1.3	1.2	1.3	1.0

Source: *Punjab Economic Report 2007*.

Table 8: Average Crop Share in Total Cropped Area in Punjab, 1990-95 and 2006-07

Period	Total Crop Area (000 hectares)	Per cent Share in Total Crop Area				
		Cereals	Fruits and Vegetables	Fodders	Cash Crops	Pulses
1990-95	14,729	54.1	3.3	14.6	20.4	7.6
2005-07	16,382	56.5	3.9	12.3	20.2	7.1

Source: *Agricultural Statistics of Pakistan 2006-07*.

Notes: (1) Cereals include wheat, rice, maize, millet, sorghum, and barley.

(2) Cash crops include cotton, sugarcane, tobacco and oilseeds.

(3) Total crop area increased by 11%; maize area by 59%; rice area by 37%; wheat by 11%; and grains by 18%.

The changes in crop area and production reveal several interesting characteristics. Among the broad groups of crops, the area used for cereals (wheat, rice, maize, millet, sorghum, and barley) expanded from 54 to 57 per cent; but the share of maize and rice increased by 59 and 37 per cent, respectively (Table 8). The area for cash crops (cotton, sugarcane, tobacco, and oilseeds) remained almost unchanged at 20 per cent and the area for pulses and fodders fell from 8 to 7 per cent for the former and 15 to 12 per cent for the latter. Fruits and vegetables occupy 4 per cent of the total crop area. These changes reflect the effects of the price and non-price factors and have important implications in terms of their effect on production and productivity. On the production side, in

the last 15 years, the annual increase in crop output ranged from 1.3 per cent for cotton to 24.9 per cent for maize, with nearly 3 per cent for wheat, sugarcane, fruits, and vegetables and 6.5 per cent for rice (Table 9). [Note: Wheat, rice, cotton, sugarcane and maize account for 65 to 75 per cent of total output and value-added by crops.] In the same period, the yield levels of major crops in Punjab increased annually by a respectable rate only in the case of maize (17 per cent), followed by rice (4 per cent), wheat and cereals (2.5 to 3 per cent), but at 2 per cent for sugarcane and one per cent for cotton (not a sustained change).¹¹

Table 9: Annual Growth Rate of Output of Selected Crops in Punjab, 1990-95 to 2005-07

(Per cent)								
Period	Wheat	Rice	Maize	Cotton	Sugarcane	Oilseeds	Fruits	Vegetables
1990-95 to 2005-07	2.9	6.5	24.9	1.3	2.8	2.0	3.0	2.8

Note: The growth rates have been computed from the data in *Agricultural Statistics of Pakistan 2006-07*.

A comparison of the yield levels of these five major crops in Punjab with those in other places shows some interesting features (Table 10). They are incomparably lower—the gaps are too large in some cases—than the yield levels in Egypt and China. But they are favourably comparable with the average levels for the rest of Pakistan and India, except in the case of rice and sugarcane. In the Indian Punjab, the yield levels of wheat, rice and sugarcane far exceed the levels in Pakistani Punjab.¹² Given the paucity of data and research, there is no way to make a firm statement about changes in total factor productivity (TFP) for crop production in recent years. Ali and Byerlee (2004) have argued that in the decade to 2003 almost all of the output growth in Punjab was due to the intensive use of inputs and resource degradation caused by factors like excessive use of chemical fertilisers, pesticides, falling water table, salinity, and mono-cropping. Another related but largely unexplored area is the impact of changes in the cost of production, given the price increases of inputs, on farm income and rural poverty in Punjab.

¹¹ In Punjab, no research seems to have been done about the effects of changes in cropping patterns and output levels on rural employment, incomes and poverty levels.

¹² Output per hectare is not a good indicator of crop productivity since it leaves out the effect of factors other than land area. Also, it gives no clue to the profitability of output without taking into account the cost of production and revenue which are affected by price subsidies.

Table 10: Yield Levels of Major Crops in Selected Countries and Areas, 2004-06

Country/ Area	(mt/ha)				
	Wheat	Rice (paddy)	Seed Cotton	Sugarcane	Maize
Punjab (Pakistan)	2.6	1.7	2.0	47.0	3.6
Pakistan (excluding Punjab)	2.1	2.5	1.5	49.9	1.1
India	2.6	3.1	1.1	63.9	2.0
Punjab (India)	4.3	3.5	1.2	59.0	2.8
China	4.4	6.3	3.5	70.6	5.3
Egypt	6.5	10.1	2.8	121.0	7.9
USA	2.9	7.6	2.4	70.3	9.6

Source: FAO database; *Agricultural Statistics of Pakistan 2006-07*; *Agricultural Statistics of Punjab (India)*.

Almost everyone in the rural areas of Punjab, and certainly families with little or no land (including the landless tenants and labourers), owns a few heads of large and small ruminants and poultry birds.¹³ These animals are a major source of risk protection (mitigation) and providers of milk, meat, hides and skins, and wool. Traditionally livestock were kept for draught power on the farm and milk for the household. Selling live animals was a sign of distress. Meat was generally regarded as a by-product. But much has changed in recent years. Most rural households now sell a large part of the milk and eggs their animals and birds produce. The rapid expansion of large-scale private commercial poultry has become an important source of meat and eggs in almost all urban and even rural areas. There has also been some expansion of commercial dairy industry in many urban areas of Punjab. However, nearly three-quarters of milk of buffalo and cattle is either consumed by the producer households or sold locally. Organised milk production and processing account for no more than eight per cent of total milk production. The meat industry is the least developed: very young male calves, dry buffaloes and cows, and sick and aged animals are slaughtered and their meat sold in the butcher shops or stalls all over the province.

¹³ The livestock production system is quite varied depending on the animals, their habitat, and structure of markets. No subsistence-level regime for livestock is left even in the rural areas of Punjab; almost all livestock holders are players in the market. However, the market orientation varies a great deal: ranging from the rural markets for live animals and dairy to the peri-urban or urban-based commercial enterprises for dairy.

Table 11: Number of Livestock in Punjab, Selected Years

Livestock	1986	1996	2006	(in thousand)	
				Per cent Change 1986-2006	Per cent Share of Punjab in Pakistan (2006)
Cattle	8818	9382	14412	63	49
Buffalo	11150	13101	17747	59	65
Goat	10775	15301	19831	84	37
Sheep	6685	6142	6362	-4	24
Poultry (domestic)	27848	24511	25906	--	35

Source: *Pakistan Livestock Census Reports of 1986, 1996 and 2006.*

As shown in Table 11, the population of large ruminants increased by just over 60 per cent in twenty years from 1986; in small ruminants, the goat population increased by nearly 85 per cent and that of sheep fell by four per cent. The number of 'domestic' poultry birds seems to have fallen by seven per cent, reflecting either bad reporting or the shift to commercial poultry not included in these numbers. Punjab accounts for nearly two-thirds of buffalo, one-half of cattle, over one-third of goat, and one-quarter of the sheep population in Pakistan. The 2006 livestock census data show (Table 12) that in Punjab millions of rural households own, on average, four large ruminants (cattle and buffalo) and five to eight small ruminants (goat and sheep). More importantly, 72-74 per cent of the households own only one to four buffalo or cattle and 69 to 75 per cent of households own one to five sheep or goat. Owners of large herds are very small in number and of them the majority are apparently not well organised.

Table 12: Livestock Holdings in Punjab, 2006

Livestock	Holders (million)	Animals per household	Proportion of Households Holdings					
			Cattle and Buffalo			Goat and Sheep		
			1-2	3-4	1-4	1-5	6-15	16-30
Cattle	3.66	4.1	46.4	27.3	73.7	--	--	--
Buffalo	4.06	4.4	43.3	28.3	71.6	--	--	--
Goat	4.07	4.9	--	--	--	74.7	21.6	2.8
Sheep	0.80	8.0	--	--	--	68.7	19.7	7.0

Source: *Pakistan Livestock Census Report 2006.*

Finally, in Table 13, the data show that annually 36.5 million tons of milk is produced in Pakistan (two-thirds of it in Punjab) and 29.2 million tons is available for human consumption in fresh and processed forms. The milk output grew at just over 3 per cent annually between 2002 and 2007. It may be of interest to note that the average output of buffalo and cattle milk per lactation (1,909 and 1,195 litres, respectively) in Pakistan far exceeds the levels in India, China and other countries in South and South-East Asia. But it is far lower in the case of cattle in countries like USA and Australia. In Punjab, the average output of milk per lactation for both buffalo (2,100 litres) and cow (1,600 litres) is higher than the average for Pakistan. Meat output is 2.3 million tons (of which 53 per cent is beef). Punjab's share is three-quarters in poultry meat, one-half in beef and one-third in mutton.

Table 13: Average Annual Output and Consumption of Milk and Meat in Pakistan, 2002 to 2007

	Milk Output and Consumption (000 mt)				Meat Output (000 mt)		
	Average	Per cent	Average	Per cent	Average	Per cent	
	Annual	Change	Annual	Change	Annual	Change	
	Gross Output	2002-07	Consumption	2002-07	Output	2002-07	
Cow	11973	31	9579	31	Beef	1240	41
Buffalo	24473	9	19578	9	Mutton	656	19
					Poultry Meat	440	49
Total	36446	16	29157	16	Total	2336	23

Source: *Agricultural Statistics of Pakistan 2006-07*.

As a preface to the discussion in the next section on policy issues (outlined in the first section), it seems relevant here to look at the provincial government's expenditure on agriculture (crops), livestock and irrigation sectors in the last five years (2003-08). The expenditure data, shown in the appendix (Tables 1 and 2), indicate at least four important features. First, the three sectors together received on average 6.3 per cent of the total government expenditure; it ranged from 7.0 per cent (2004-05) to 5.4 per cent (2006-07).¹⁴ Second, the proportion of total capital expenditure incurred for the three sectors was higher (8.9 per cent) than the total current expenditure (4.9 per cent) and the former ranged between 6.7 and 11.2 per cent whereas the latter varied between 4.3 and

¹⁴ According to the data cited by Ali and Byerlee (2004), share of the three sub-sectors in the provincial budget was around 14.5 per cent in the early 1990s. It should be added that the farm economy benefits from the investment and expenditure that different levels of government have made in building and maintaining roads and other rural infrastructure and providing electricity.

5.5 per cent. Third, in real terms the average annual growth rate of expenditure on agriculture, livestock and irrigation (17.8 per cent) compared favourably with the total provincial expenditure (16.4 per cent). Finally, among the three sectors, irrigation received the bulk of the share (65 per cent), followed by agriculture (25 per cent) and livestock (10 per cent). One more point of interest is that the expenditure on agriculture, livestock and irrigation makes up only 2.0-2.5 per cent of the agriculture value-added in Punjab. It is clear from these numbers that a very small proportion of the government budget has been given to those sectors of the provincial economy that make a substantial contribution to the province's GDP and labour employment.¹⁵

3. Policy Issues for Agricultural Growth

3.1. Land and Water Resources

The land and water resources needed for sustaining a decent agricultural growth rate—say four to five per cent per year—in Punjab are inextricably linked to each other. Much as this interdependence is important, the evidence seems to suggest that the co-ordination among various public sector agencies is either non-existent or weak at least at the field level. The land and water issues are discussed here separately for analytical convenience.

3.1.1. Agricultural Land

There are at least three aspects that impinge on the availability and efficient use of land for agriculture in the future. First, the land area available for agriculture is being competed away by rapidly rising demand for urban and industrial use with the growth of population, migration of people from rural to urban areas, and increased incomes. Second, the quality of agricultural land has been declining because of soil erosion and desertification, water-logging and salinity, and poor land management practices at the farm level. Third, management of land for agriculture is affected by the property rights in land and contracts about its use.

¹⁵ There is also the issue of expenditure priorities for the three sectors. The irrigation sector seems to get a disproportionately high share for O&M expenditure whereas the government collects only 40 per cent of this expenditure from water users (farmers).

The rapid growth in the demand for land to build houses, factories and other structures and roads is eating into farm land and this pressure is likely to increase.¹⁶ It seems that the zoning laws of the local (municipal) and provincial governments are either flawed in design or not enforced effectively to protect and preserve (good) farm land: in many countries laws exist and are strictly enforced for the protection of productive farm land. The almost seamless expansion of towns and cities and factories are not only at the expense of farm area—they raise the value of land on which farming becomes a far less profitable enterprise—but tend to pollute and degrade the quality of land for farming. Since the farm area once lost to uses other than farming is almost never recovered, and given the paucity of 'culturable' land in Punjab, it is important to both, protect the existing farm area and improve the quality of agricultural land.

The loss of quality in agricultural land in Punjab has been well documented in terms of its extent and the sources of land degradation (Ali and Byerlee, 2004; Government of Punjab, 2007). Three to four million hectares of agricultural land is affected by various degrees of salinity and sodity—water-logging is no longer a major issue thanks to the efforts in the 1970s and 1980s, excessive extraction of groundwater by tube-wells, and recent droughts. About 12 per cent of the irrigated area is saline and five per cent water-logged. Soil quality and nutrient balance—soils are generally low in organic matter, nitrogen and phosphorous—have been severely harmed by excessive use of unbalanced chemical fertiliser, improper field management practices about land levelling and irrigation, and pollution caused by the residual effects of pesticides used indiscriminately on crops. It is estimated that the growth of TFP in Punjab agriculture would have been 42 per cent higher had there been no or little land degradation during 1970 and 1996 (Ali and Byerlee, 2000). There is no evidence that the process of land degradation has been slowed in recent years. The policy issues involved here are clearly related to (i) subsidised price of water, (ii) bad irrigation practices, and (iii) use of unbalanced chemical fertilisers and excessive application of pesticides. These problems seem to reflect a failure of the relevant public sector agencies to provide credible demonstration and create incentives for the adoption of profitable alternatives through land levelling, zero tillage,

¹⁶ See Government of Punjab (2007). It is argued by some that the loss of agricultural land to the urban and industrial use indicates that the sale of land by owners for alternative use brings a higher return than what they get from farming. But does it serve the public good, given the concern about food security and the degradation of resources and the environment?

water conservation, use of green manure (legumes) and crop and animal waste, and integrated pest management (IPM).¹⁷

The third important aspect is of land tenure, which defines a nexus of complex relationships about the rights to own and use land. The issue of land tenure reform, regardless of its merits based on design, implementation and effects, is apparently not on the policy agenda at any level in Pakistan, notwithstanding the occasional lip service paid in the official and donor documents.¹⁸ It should be added that apparently the provincial government in Punjab is considering a scheme to distribute government land to the near landless and landless rural households in some of the poor southern districts of the province. In the planned (pilot) project, each poor rural household will be given a small parcel of land (about one-tenth of hectare) to build the house and establish a 'kitchen' garden for vegetables. This approach has been advocated by some well-placed international consultants and supported by donors. However, it is not without controversy and the evidence of how it works is quite mixed.

The evidence extracted from the censuses and other reports on the distribution of ownership and operational holdings by size and tenure does not shed much light on the rights of property in agricultural land for its ownership and management. It is well known that no resource can be used efficiently if the rights to its ownership and use are not well defined and protected by law. In Punjab, as in other provinces, the record of rights to land is simply about the fiscal responsibility (payment of land revenue) of the individual for a piece of land of which he/she is presumed to be the owner/holder but does not have a certain title.¹⁹ Since the state does not guarantee title to that piece of land, it is subject to expensive and lengthy litigation between individuals. In the colonial period, the revenue officials used to update the record of rights through periodic (every 20 years or so) 'settlements' for land revenue between

¹⁷ Recent experience of IPM through Farmer Field School (FFS) in some areas of Punjab has produced good results that need to be supported for replication in other areas.

¹⁸ The author has written extensively on changes in the agrarian structure of Punjab and Sindh with special reference to land tenure reforms (Khan, 2006). Two points should be added here. First, the land reform ordinance of 1977 was rescinded—after the land reform acts of 1959 and 1972 which were implemented—by the federal government in the 1980s. Second, the Federal Shariat Court has ruled that a ceiling on landholdings is not in accordance with Islamic laws. The federal government's appeal is pending with the Supreme Court.

¹⁹ See Government of Punjab (2007) for a detailed description of the issue of land records in Punjab.

the state and landholders. It seems that the land record has gradually deteriorated, perhaps more so after the 'devolution' of 2001, because of poor land revenue management. The questionable record of (presumptive) ownership of land and associated contracts, together with competing jurisdictional domains of the civil and revenue courts, have been the major road block in the development of an active market in agricultural land. The existing land market is thin and plagued with opaque transactions.

The attempts so far to improve the quality of land record even on a pilot basis in four districts of Punjab have not yielded the anticipated results because of questions about the legality of the 'computerised' land record without involvement of the stakeholders and the apparent resistance by some powerful interests. It is certainly no improvement to simply copy the existing hand-written and quite messed-up land record. The basic issue is to recognise in law the right of ownership to land, confer and register the title, and maintain transparent and easily accessible land record about landownership and tenancy contracts. Rapid land survey technologies are available, provided there is the requisite political will backed by adequate administrative capacity and resources. All stakeholders, including the presumptive owners and tenants, should be involved in this process. In addition, the rules and regulations governing disputes on land (for ownership and management) should be simplified and the access to courts made easier and cheaper. In fact, good land record will help reduce the need for people to go through litigation and create incentives for the development of a vibrant land market.

3.1.2. Irrigation Water

Arid Pakistan is one of the most water-stressed countries in the world (World Bank, 2005b). Water scarcity is likely to remain the most important single challenge to accelerate the growth of irrigated agriculture in the Indus basin. In Punjab, the vast canal irrigation network—there are 24 main canals—from the Indus and its four tributaries (Jhelum, Chenab, Ravi, and Sutlej) has been built, expanded and maintained by the federal and provincial governments for over 150 years. In recent years, it has come under great stress because of its faltering capacity to meet the rapidly growing demand for water. The projections are that, based on the estimated requirements for agriculture, industry, infrastructure, and housing, there would be an overall 'water

gap' of 25 to 30 per cent in the next 15-20 years.²⁰ On the supply side, the total amount of water in the rivers from rain and snowmelt—both of which are vulnerable to climate change—is falling; there is limited storage capacity, reportedly for only 30 days; the irrigation infrastructure is not well maintained; there are gross inefficiencies in the conveyance of canal water to the farm-gate; and farmers generally use inappropriate methods of water management. It should be added that in Punjab about 12 per cent of the irrigated area is saline and 5 per cent water logged. Salinity is the major concern given the rising pressure on both surface and groundwater and poor water management.

In Punjab, groundwater accounts for 60 per cent of water at the farm-gate, but much of it is contributed directly and indirectly by the canal system. Privately owned but well-subsidised tube-wells, nearly 800,000 of them, have helped to alleviate the problem of water-logging and increased the cropping intensity by providing supplemental water on a reliable (on-demand) basis, although the increasingly unreliable supply of electricity and the rising cost of energy in general have become severe constraints.²¹ In fact, groundwater pumped by tube-wells has contributed nearly three-quarters of the increased water supply at the farm-gate. But there is good evidence that the groundwater is being mined, by tube-wells and 'skim' wells, far in excess of the recharge in the aquifer, hence depleting a very valuable resource base for water (World Bank, 2005b). Given the alarm bells, the Irrigation and Power Department (IPD) of Punjab Government has put in place a groundwater monitoring system, but there is no regulatory framework or mechanism to restrain the overexploitation of groundwater. It has been suggested that the rights to groundwater be vested with the state (provincial government) and entitlements be given to individuals. The question to be resolved by governments and users is how?²²

The productivity of water—crop output per unit of water used—in Punjab is even lower than the productivity of land when compared with the Indian Punjab and the United States: the respective ratios in wheat are 5:8:10 for water and 3:6:10 for land (World Bank, 2005b). The low

²⁰ See World Bank (2005b). It is perhaps the most comprehensive study of water resources in Pakistan with emphasis on the current state, estimated future supply and demand, and the policy agenda to address the multiple challenges.

²¹ The federal government has been subsidising the cost of boring for tube-wells and pumping water from them.

²² See World Bank (2005b).

water productivity is a reflection of serious deficiencies in the distribution and application of water, ranging from unreliable and inequitable distribution and bad water management practices on the farm, including flooding of uneven fields, cultivation of water-intensive and low-yield crops (e.g. sugarcane and rice), because of price distortions and poor extension services. The share of wheat, fodder and vegetables is far lower in water requirements than in crop area, but opposite is the case sugarcane, rice and cotton. More attention needs to be given to crops that can yield more with less water, thrive on low-quality water, and resist droughts and salinity.

The water entitlement (*warabandi*) system on watercourses, controlled by IPD, has become quite unreliable and inequitable as reflected by the difference in water supply to the head- and tail-end users, large-scale water theft, and pervasive rent-seeking by the irrigation officials. It is estimated that the tail-enders receive 40 per cent less water than do the front-enders (World Bank, 2005b). The *warabandi* system—equal time to every user on an outlet—has become completely out of date and a cause of maldistribution and much waste of water along the system. The challenge is to shift from a time-based to volume-based water entitlement system which will allow users to conserve and trade water. Since this shift would involve complex institutional and technical issues—from the canal-head to the farm-gate—it should first be tested on a pilot basis with great care. In addition, the canal infrastructure (assets) worth about US\$20 billion—requiring about US\$2 billion in deferred maintenance—has not been maintained adequately, given the low level of O&M expenditure, leakages from what is allocated by the government and the poor quality of work (World Bank 2005b). It is estimated that the delivery capacity of canals in Punjab is 30 per cent below the design because of deferred maintenance and lack of rehabilitation. The water charge (*abiana*) generates annually less than one-half of the expenditure on O&M. The *abiana* collections (including arrears) amount to Rs.1.5 billion—Rs.2.0 billion is the assessed amount—compared with Rs.5-6 billion spent on O&M, of which 75-80 per cent is spent on staff salaries and benefits. Interestingly the *abiana* revenue goes into the general revenue of the provincial government.

In 2005 Government of Punjab initiated a multi-year 'Punjab Irrigation Sector Reforms Programme' (PISRP) to address the serious challenges faced by the irrigation system. The four 'pillars' of this programme are: institutional and policy reforms; water resource management reforms;

irrigation service delivery reforms; and on-farm water management reforms (Nadeem and Asrar-ul-Haq, 2008).²³ One of the important achievements so far is the daily data-tracking system for the distribution of canal water in 3,164 channels throughout the province. It makes the irrigation officials aware of their responsibility, increases accountability and adds flexibility to the distribution network.

The other and perhaps a more important development is the experiment of a new water delivery system in which the water users (farmers) are expected to play a key role. In the mid-1990s, with the support of the World Bank and Asian Development Bank, Government of Punjab and other provincial governments decided to gradually move away from the centralised irrigation management system controlled by the irrigation department. Consequently, in 2001, Government of Punjab established the Provincial Irrigation and Drainage Authority (PIDA) under the Punjab Irrigation and Drainage Authority Act of 1997.

The new water delivery system has a three-tiered structure. PIDA is at the top—expected to gradually replace IPD—and governed by a Board made up of representatives of the government and farmers. The next tier is the Area Water Board (AWB), in each canal command area, which is governed by a Board on which a majority of members are representatives of farmers and non-farmers from outside the government. Both PIDA and AWB are public sector organisations. The last tier is of Farmers Organisation (FO), one at each distributary or minor canal, owned and controlled by farmers involved as water users.²⁴ The General Body of the FO, comprising one elected member from each watercourse (representing the *khal* or *nehri panchayat*), elects a Management Committee (MC) of nine FO members for three years. Each FO is responsible for maintaining the water and drainage infrastructure, regulating the *warabandi* system, and collecting the *abiana*. The FO can retain 40-50 per cent of the *abiana* revenue to run its business. It has the authority to hire the necessary technical and support staff within its budget and PIDA arranges for the service of a revenue assistant to assess and collect the *abiana* and recover

²³ Government of Punjab has received financial and technical support from the World Bank (three Development Policy Loans of US\$300 million), Asian Development Bank, and Government of Japan.

²⁴ There are serious questions and reservations about the effectiveness of associations of farmers and water users, given the unequal distribution of land and a faction-ridden social structure in many areas of Punjab.

arrears.²⁵ In 2005, the Lower Chenab Canal East (LCCE) was selected as the pilot area where one AWB was established in the canal command area and 85 FOs were formed on the distributaries, with the *khal panchayat* at the watercourse level. In the last year or so, three more AWBs have been established with about 200 FOs on four main canals (Lower Chenab Canal West, Lower Bari Doab Canal, Bahawal Canal, D.G. Khan Canal, and Chashma Right Bank Canal).

The experiment of LCCE has produced mixed results. For one thing, just over one-quarter of the FOs have performed well and about the same proportion have 'failed'; the rest are somewhere in between. Overall the evidence is that the incidence of water theft has gone down, water is more equitably distributed, and water disputes have been reduced. However, there are problems. The *abiana* collections, after going up to 88 per cent of the assessed amount, have gone down to about 50-60 per cent.²⁶ One of the major reasons is the weak support provided by the deputed revenue official. The FOs are allowed to retain 40 per cent of the *abiana* revenue for O&M, but they are under-spending their share because of (i) the large-scale canal rehabilitation programme by the provincial government and PIDA and (ii) lack of necessary technical and management capacity in the FOs. Another important problem is that the irrigation staff—most of them are former employees of IPD—hired by the FO is not well paid and feels insecure because of changes in management at the FO level following elections. This tends to undermine the capacity of each FO to maintain the infrastructure and regulate the supply of water to users. Finally, the water entitlement (*warabandi*) system is based on time and not volume. There is no evidence that PIDA has studied these issues in the context of the first experiment on LCCE and incorporated the lessons in the expanded programme.

In the long run, water rights in the canal command areas will have to be regulated by volume and its reliable supply assured on demand. In addition, the regulated water will have to cover the marginal cost (opportunity cost) or reflect the value-added at the farm level. Water pricing should reflect the fact that, while the infrastructure for water is a public good, water itself is a scarce private good.²⁷ Why not try it in at

²⁵ See Government of Punjab (2008).

²⁶ The *abiana* assessments are based on the average of the preceding three years.

²⁷ Recent studies of the effects of water availability for irrigation have produced interesting results (World Bank, 2004). For canal water, if the opportunity cost of water to farmers is raised it will (a) change the cropping pattern in favour of less water-intensive crops (b)

least one canal command area in which the canals and watercourses are being rehabilitated or modernised?²⁸ The worthwhile experiment can be conducted on a small number of watercourses in one canal command area starting at the tail-end: let the tail-enders get reliable and measured volume of water on-demand and then gradually move the system to the front-end of the watercourse.

All of this is likely to take some time even if earnest efforts are started now. The more readily doable activity is to intensify efforts to increase water productivity at the farm level. It seems that a disproportionately high level of attention, in terms of investment and human resources, is given to the lining (physical improvement) of watercourses to reduce the loss of water before it reaches the field but not to its management on the farm. There are at least three issues here and all of them reflect serious policy deficiencies and poor quality of extension services. The first has to do with the distorted price signals and market structures for farm inputs and enterprises which result in the cultivation of crop combinations that demand water, but the return on water is not maximized. Second, the land and crop management practices do not include investment in land levelling and minimising on tillage where the soil structure permits. Finally, farmers have not been weaned away from flooding their fields to adopt alternative technologies that save water and promote optimum plant growth.²⁹ All of these points tend to indicate that the public sector water and crop extension services have had little or no effect, and the relevant policy challenge is to help alleviate the resource and knowledge constraints of farmers.

increase water efficiency on crops, (c) expand the cultivated area, and (d) raise the yield level on farms at the tail-end. Increased availability of groundwater with more efficient and better regulated markets will reduce the gap between tube-well owners and purchasers of tube-well water and raise the overall productivity of crops as well.

²⁸ The World Bank (2005b) report on water includes a very interesting discussion of this issue and highlights the multiple constraints.

²⁹ The federal government has launched a four-year (2007-08 to 2011-12) country-wide high-intensity irrigation project worth about Rs.18.00 billion, of which Rs.6.92 billion have been given to the Department of Agriculture to cover 52,610 hectares in all districts of Punjab. Will it work? The high-intensity irrigation technologies, based on sprinklers and drip or trickle pipes, are quite expensive in terms of initial investment and their maintenance and would require cultivation of commercial crops well integrated into the value-chain for domestic and foreign markets. Further, given the relatively cheaper alternative sources of water and the demanding requirements for technical support in the new technologies, the returns on investment seem to be not too high.

3.2. Production and Distribution of Seed

Good seed—used in adequate amount and at the right time—is a key ingredient in raising the yield level of crops as was the experience of the ‘Green Revolution’ for wheat and rice in the late 1960s and early 1970s and cotton and *basmati* rice in the mid-1980s. The problem is that most farmers depend on their own harvest for seed to plant in the next season. It is estimated that, in Punjab, ‘improved’ (certified) seed—about 165,000 tons annually in 2004-07—accounts for only 12 to 14 per cent of the seed used by growers, of which the share of the public and private sectors is almost equal. Further, about 90 per cent of the improved seed is of wheat (75 per cent) and cotton (15 per cent) crops.³⁰ What explains this state of the seed business in Punjab? Needless to add, the seed business is regulated by both the federal and provincial governments.

In view of the importance of certified (proven) seed and its limited availability in the country, the federal government enacted its first Seed Act in 1976. The federal government established the Federal Seed Certification Department and the National Seed Council as the national regulatory agencies for registering the new crop varieties, controlling the quality of seed, and regulating the seed trade. The provincial government established the Punjab Seed Council and the Punjab Seed Corporation (PSC). The task of PSC was to multiply the pre-basic and basic seed—purchased from public sector research institutes—on its own farms and through registered growers, process the seed and distribute it through a network of registered private retailers. The Seed Act did not allow the private sector to participate in the development of the seed industry: the public sector was given the monopoly to produce and sell crop seed. The consequence was that (i) the public sector could meet no more than 6-7 per cent of the seed requirement; (ii) there were pervasive complaints about the quality of seed; and (iii) the provincial seed corporations were a drain on the government budget.

As part of the structural adjustment process in the 1980s, the federal government started to create a competitive environment for the private sector to produce and distribute seed. Consequently the seed sector was

³⁰ See Government of Pakistan (2007a). There is no harm if growers use the home-produced seed provided they can maintain its purity. But a vast majority of farmers in Pakistan do not have the wherewithal to meet this condition. The important point is that if the quality of seed is compromised it can adversely affect crop productivity.

opened up for private business in two steps. First, with the adoption of the 'truth-in-labelling' rules in 1991, multinational companies were allowed to trade in seed after getting their hybrid seed approved and registered in Pakistan. Second, in 1994 the federal government declared the seed industry at par with other industries which allowed the domestic private sector seed companies to expand their business. In Punjab, the result is that besides PSC about 600 registered private seed companies and four multinational companies—Monsanto being the main player—are active in the seed industry. However, PSC enjoys a monopoly on the breeder seed of new varieties produced by the public sector research institutions. In addition, the regulations for the protection of breeders' rights and bio-safety are not in place to give incentives to the private sector to introduce new (e.g. genetically modified) seeds of crops like cotton.³¹

Several problems are encountered by farmers and seed companies in developing a competitive and efficient seed industry. First, almost all of the seed for vegetables is imported and so is the hybrid seed for some other crops (maize, sunflower, and canola). Second, apparently many of the private sector seed companies acquire pre-basic and basic seed from the public sector research institutions, multiply and distribute to growers without going through the long and cumbersome process of registration and certification. It appears to be a lucrative business for the parties involved in it, but poses serious problems for quality protection and disease control. Third, almost no progress has been made in importing or producing the genetically-modified seeds (e.g. Bt cotton) because of the federal government's apparent sensitivity about the ban on the import of genetically-modified products in the European Union. However, it is widely reported that about one-third of the cotton area is covered by unlawfully imported seed of Bt cotton. Government of Punjab (Department of Agriculture) is currently negotiating the terms with one of the multinational companies (Monsanto) to import the genetically-modified cotton seed.

The measures needed to address these problems include, one, given the results of a recent assessment of its operations and financial position, PSC should find a role and perhaps focus on minor crops, produce

³¹ The regulations to protect the rights of breeders have not been legislated by the National Assembly though the process was initiated some years ago. The absence of this protection has been a major hurdle for breeders and seed companies to produce and multiply improved and hybrid seed of crops.

seedlings of fruits and vegetables, and train small farmers and small-scale seed enterprises.³² In any case, if it remains in the seed business then it has to develop the capacity to compete in the marketplace and not drain the government budget. Two, the procedures for varietal registration and certification should be simplified and the federal institutions should focus on policy issues and get out of the seed testing business. And three, the provincial government should remove the licensing requirement for seed retailers and registration requirement for seed growers. Government should limit its role to enforcing the rules and regulation about 'truth-in-labelling' and seed safety and quality with respect to diseases. The onus should be on the accredited private sector laboratories to provide the necessary evidence and proof.

3.3. Agriculture Research and Extension Services

To achieve and maintain a sustainable agricultural growth process in Punjab, the focus should be on (a) increasing the productivity of resources (land and water) and outputs (crops and livestock products) and (b) shifting the production system from the low-value to high-value farm enterprises through diversification and specialisation. The policy package would have to include at least three ingredients: (i) effective institutions for the production and transfer of technology; (ii) adequate access to financial capital and investment in human capital for small farmers in particular; and (iii) undistorted and competitive market structures for farm inputs and products. The adoption and use of new technology and practices in agriculture depend on its availability, resource constraints faced by the farmer, and the profitability of technology. On the demand side, a vast majority of farmers in Punjab, as in other areas of Pakistan, are severely constrained by lack of access to financial capital and possess little human capital (low level of functional literacy) to adopt and use profitable farm technology and practices. These constraints have a demonstrably significant effect on the process of adoption and use of new technology. On the supply side, there are problems with the production and transfer of profitable technology and the markets for inputs and products. The latter would require a major shift in policies regarding the structure and operation of markets for output of crops and livestock. This issue is addressed in the next section.

³² See A.F. Ferguson & Co. (2007). "An Assessment of Future Role of Punjab Seed Corporation." Draft Final Report for Government of Punjab.

3.3.1. *Agriculture Research*

The agriculture research and extension agenda should include (i) improvement of the genetic stock of crops and animal breeds and (ii) transfer of efficient and profitable farm practices that economise on land and water, conserve the resource base, enhance the quality of farm products in the value-chain, protect human and animal health, and preserve the environment. A quick review of the agriculture research system and extension service in Punjab reveals a number of problems.³³ For one thing, most of the research is in the public sector and so is the extension service. The private sector is active mostly in providing information about those technologies or inputs which make the largest contribution to the bottom-line of the company. In research, it has been hampered by a less than friendly policy environment: rules and regulations on varietal protection and bio-safety are not in place though required under international treaties.³⁴ Finally, the agricultural research system has had almost no systematic planning and appropriate monitoring mechanism in place, resulting in lack of co-ordination and collaboration among the stakeholders, waste of resources through duplication of work, and less than desired outcomes.

It is well known that the funding received by public sector agriculture research system and extension service is between 0.2 and 0.3 per cent of the valued-added in agriculture. And a high proportion, ranging between 80 and 90 per cent, of the current expenditure goes to salaries and benefits for the staff. In addition, the quality of research and extension service has apparently declined for a number of reasons: faulty institutional structures; lack of proper co-ordination between the stakeholders; inadequate and distorted incentives for the professionals; overstaffing of institutions; and lack of necessary training support to enhance the skills and build human capital. All of this has adversely affected the quality of output.

In Punjab, until the mid-1970s the three public sector agencies for agriculture education, research and extension were part of the

³³ See Ali and Byerlee (2004) and Government of Punjab (2007). It would be important to estimate the economic return to agriculture research and extension service in Punjab since this important issue has not been studied or researched for some time.

³⁴ The feet-dragging by governments in Pakistan on regulations has deprived breeders, growers, consumers, and exporters of the economic benefits of hybrid and insect-resistant seeds of crops. In the meantime, farmers have introduced these seeds without proper testing and approval resulting in widespread incidents of disease.

Department of Agriculture and the Department of Livestock administered the veterinary education and field services. This system was changed first in the mid-1970s when the Agriculture and Veterinary Colleges were upgraded as universities and made independent of the Departments of Agriculture, and Livestock, respectively. The second change came with the devolution plan in 2001 when the field service for agriculture extension and veterinary, together with the on-farm management operations, were transferred from the provincial to district government and the provincial Departments of Agriculture and Livestock were left with technical support services for the district-level field staff.³⁵ Both of these changes, and particularly in the extension service, have made everyone's work little more difficult and require far greater co-ordination among the public sector agencies involved in the production of human capital for research and extension (independent universities and faculties of agriculture and livestock), research institutes (which remain with the Departments of Agriculture and Livestock), and the bifurcated extension service (split between the provincial and district governments).

In Pakistan, and Punjab is no exception, it seems that the agriculture research system has focused for too long on the agronomy of a small number of crops, particularly wheat, cotton, rice, maize and sugarcane, with very limited attention given to the location-specific problems of land and water resources, fruits and vegetables, non-traditional oilseeds, post-harvest management, and livestock (except for disease control). The system was not designed to be responsive to the changing demand of farmers, particularly small farmers, for new crop seeds and cropping patterns, integrated land and water management practices, and livestock breeds and their feeding practices. The change has been slow in coming.

The agriculture research system in Punjab includes a central multi-disciplinary research institute on crops and many regional institutes and commodity-oriented experimental stations, some federal institutions (e.g. Pakistan Agricultural Research Council and Pakistan Atomic Energy Commission), and agriculture and animal husbandry universities and faculties. A major problem is that the research conducted by these entities is fragmented (compartmentalised), without proper co-ordination, and dependent mostly on informal arrangements among institutions and individual researchers. Efforts are under way in Punjab and at the federal

³⁵ The agriculture engineering and agriculture and livestock research services remain with the Departments of Agriculture and Livestock Dairy Development. .

level, particularly about the structure and operations of the Pakistan Agricultural Research Council (PARC), to reorganise the system.³⁶ In the last two years, two important changes have been made in the agriculture research system in Punjab to address the identified problems and improve the effectiveness of the Research and Development (R&D) efforts for the farm sector.

First, the provincial government has reconstituted the Punjab Agriculture Research Board (PARB) and given it Rs.1.00 billion to facilitate the agriculture research system to do its work effectively. Second, five provincial research institutes (cotton, rice, sugarcane, mango, and citrus), along with their stations and sub-stations, have been converted into government-owned companies registered under the Companies Ordinance of 1984. Each of these research and development (R&D) companies has been given Rs.2.00 million and the process of transfer of assets and liabilities and selection of staff is under way. These issues are quite complex and are likely to take some time to resolve. The long-term plan is to transform all of the government research institutes to corporate entities. The purpose of these changes is to 'revitalise' the agriculture research system in the province, moving away from dependence on the administratively centralised research institutes, engaged in fragmented research and not necessarily responsive to demand. PARB has adopted a theme-based competitive grant system for researchers, working in the new corporate entities, government research institutes, universities, and the private sector.

It is too early to make any judgment about the likelihood that the proposed research system would be accepted by the vested interests. The hope is that the new approach, which emphasises institutional autonomy and integration of work among scientists, induces competition and collaboration, and offers proper incentives, will have their intended effects. However, there are at least three unresolved issues. First, will the proposed system be accepted and given the necessary support by the provincial government and researchers?

³⁶ Since 2001 the Asian Development Bank, as part of its Agriculture Sector Programme Loan (II), has been trying to help reorganise PARC and the provincial agriculture research and extension services. This has been a very slow and difficult process, but there are clear signs that change is on the way. In the context of PARC, see Ali and Ashraf (2007). It seems that PARC has made significant progress in its efforts to achieve greater administrative and financial autonomy, receive more financial resources, redefine its functions, and reorganise its institutional structure with emphasis on attracting and retaining the professional staff. [Note: This information is taken from a note, "Recent Developments at the Pakistan Agricultural Research Council, Sep. 2005 – May 2008", sent to the author by the Chairman of PARC.]

Second, what are the major transitional issues in terms of reallocation of human and financial resources? Third, how can (or will) the universities, provincial research and extension establishments and the private sector improve their collaboration to develop synergies? Apparently there is no clear vision on these issues, nor any written strategy or plan.

3.3.2. *Agriculture Extension*

The real test of new farm inputs, technologies and practices is with the end-user: farmers and livestock holders. It is not enough that the new (efficient and profitable) technology is produced. It must be taken to the end-user for adoption and diffusion. The impact of agriculture research depends on its successful transmission to farmers, in which the extension service is a critical link. In the post-Green Revolution period the farming environment has grown more complex with increased diversification and intensified use of inputs. Farmers need to switch from dependence on the intensive use of inputs, especially chemical fertilisers and pesticides, to new strategies that conserve resources to sustain growth in productivity and profitability. It is clear that a one-way, standardised message (or recipe), approach long used by the public sector agents in Punjab cannot be effective. The knowledge and management skills needed to adapt to the fast-changing agricultural environment can be best imparted by an extension service that has the capacity to solve problems in diverse settings and in response to the demand of farmers. This task is all the more challenging since a high proportion of farmers and livestock holders are not functionally literate.

Several studies have shown that in Pakistan the large army of extension agents has not served the farmers well. The top-down supply-driven model of extension service—poorly funded and staffed by inadequately trained personnel—has clearly failed. The weak and ineffective linkage between agriculture research and extension service has been no less responsible for this outcome. In Punjab, the centralised and supply-oriented public sector extension service has had serious problems: its messages and demonstration methods are too general; its service is geared to meeting the needs of a small proportion of farmers; it depends on an army of field staff not too well trained and given little incentive for good work; it receives very limited resources; and it is not too responsive to the changing structure of demand for new technology, inputs and products.

In 2002 the provincial extension service was 'decentralised' in that the budget for field work, and the staff were transferred to the district

government and the provincial government retained the technical support staff with responsibility to produce messages and transmit them to the field staff and provide periodic training. Apparently this division has produced very mixed results, depending on the goodwill of the district government (its elected and administrative officials) and their relationship with officials in the provincial Department of Agriculture. It is commonly observed that, given the preference for investment in tangible infrastructure, the agriculture extension service tends to be at the bottom of the totem pole. In addition, since the production system in agriculture depends on factors and environments not defined by the district boundary, the new system has created serious problems of co-ordination between workers in different districts. The Department of Agriculture has lost its autonomy to manage the field service on an integrated basis. It has also made the work more difficult for the research institutes since they are centrally administered. What is the real experience so far and what if anything needs to be done differently?

A major effort is needed to make the agriculture extension service responsive to the end-user's changing demand and needs. Farmers' demand for information about new technologies, crops and livestock and resource management can be met best by localised adaptive research establishments to act as the meeting point for suppliers and demanders. These adaptive research units should become the nodes for two-way dissemination of information between the research establishments (suppliers) and farmers (demanders). In fact, a large part of the extension service can be delivered effectively through these entities in collaboration with the private sector companies and farmer (village) organisations. The cost saving from a significantly reduced size of the extension bureaucracy can be used to improve the research-based delivery system and rural education. Farm organisations and individual large farmers will respond positively to the idea that good quality and economically profitable information is worth paying for. This approach will require (i) crop, livestock and resource management research with greater site specificity and decentralisation, (ii) more effective co-ordination between, if not reintegration of, the agriculture education, research and extension systems, and (iii) direct involvement of farmers in identifying problems, setting priorities and implementing technology packages. Needless to add, literate farmers, with formal or informal education, are better adapters than the less literate to the fast changing technological and economic environment.

The ongoing experiments of farmer field schools (FFS) in Punjab, together with the federally-supported crop maximisation and livestock development projects, have opened new windows of opportunity to overhaul the extension service.³⁷ Let the participatory farmer (village) organisation, especially of small farmers and livestock holders, be the focal point for the field staff to interact: move away from the army of field assistants to a much smaller number of well-trained agriculture specialists, supported by the location-specific packages of technology (inputs, practices and products) produced by research, working with other catalysts (agents) involved with the farmer (village) organisations. In other words, well-trained and motivated agriculture extension agents should become part of the teams for integrated farm and livestock management and market services. The lessons from the experience of the Rural Support Programmes (RSPs) and *Idara-e-Kissan* in Punjab should be internalised and scaled up. The medium- to long-term goal of the public sector extension service should be to compete with the private for-profit and not-for-profit agencies in meeting the needs of farmers, particularly small farmers, for a productive, diversified and profitable agriculture that can sustain itself and reduce rural poverty. It is equally, if not more, important to harness the communications technologies—radio, TV, mobile phones—for reaching the farmers, small ones in particular, with powerful messages in different forms to make agriculture more productive and profitable. In this the public sector extension service should play the lead role in collaboration with private sector agencies.

3.4. Markets for Selected Agricultural Products

Almost all small and large farmers produce crops and keep livestock to earn income. Most of them try to retain some of what they produce for the household food security and their livestock serves them as a valuable asset to cushion economic shocks. There are literally no 'subsistence' farmers today: the cash nexus has become too strong for almost every farmer. Typically small farmers tend to buy back some of the products to meet the household demand. As never before, markets are a very important part of the agriculture system: their performance affects production plans and levels, productivity of resources, and income levels

³⁷ In the scaled-up crop maximisation and livestock development projects in several districts of Punjab, the basic approach is to first help farmers and livestock holders to organise themselves and then use the organisation as the conduit to receive an integrated package of inputs and services, including group-security loans and market services.

of farm producers and livestock holders. The performance of markets in turn depends on several factors. The important ones include: distribution of market information, access to infrastructure, and public policy and rules, along with their enforcement, to stimulate competitive behaviour (for efficiency) among the participants (buyers and sellers).

In Pakistan, much progress has been made in the last 10-15 years in the operations of markets for agriculture products and inputs. Some of this progress has been part of the structural adjustment process, which began in the mid-1980s, and some in response to the ongoing World Trade Organisation (WTO) negotiations on international trade in agricultural products. However, there are serious problems, particularly in the rules and regulations about domestic and foreign trade. Some of these problems hamper the private sector in playing its beneficent role in terms of investment in post-harvest technologies, processing and market infrastructure. Many of the rules and regulations are as intrusive as they are unnecessary (e.g. controlling market transactions and movement of goods). On the other hand, where rules are necessary, they either do not exist or not well enforced (e.g. grades and standards for products and health and safety of producers and consumers). In addition, given the three-tiered structure of government, the rules and regulations of the federal, provincial and local governments are not always consistent or consistently enforced.

In this section, the focus is on the operations of markets for fruits and vegetables and livestock products (milk and products, live animals, and meat), given their importance to meet the growing domestic demand, earn (or save) foreign exchange, raise farm incomes, and reduce rural poverty. The emphasis throughout will be on the regulatory framework and enforcement of rules and regulations for fair and efficient market operations.

3.4.1. Fruits and Vegetables

The first signs of a nascent 'horticulture revolution' are visible in almost all irrigated areas of Punjab: look at the growth of the peri-urban and off-season vegetables and the export of fruits like citrus and mango.³⁸ There are several good aspects of the rapid growth in the production of fruits

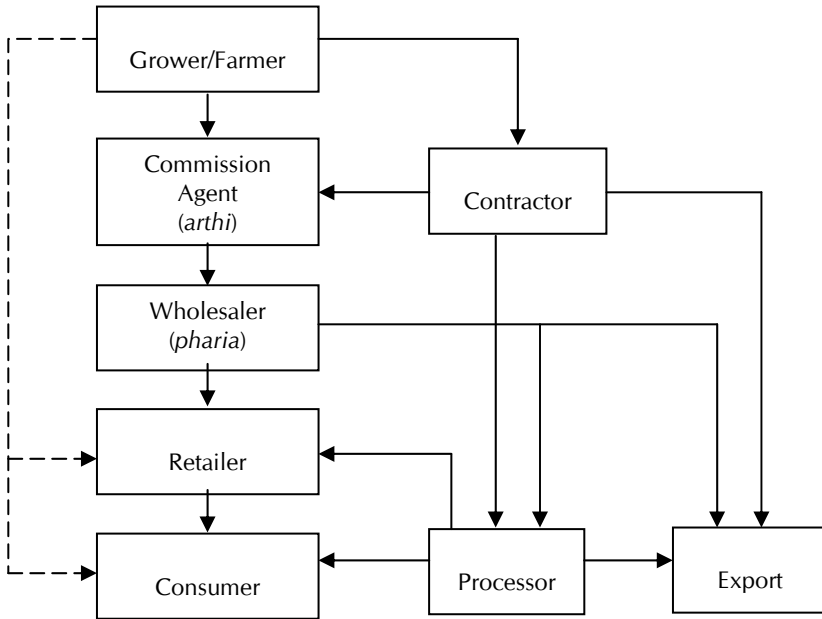
³⁸ See Ali (2007) in the context of world-wide growth of fruits and vegetables with their effects on income, employment and trade. There are good published accounts of the growth in production and export of citrus fruits (*kinnow* in particular) and mangoes in Punjab. Much of this reflects private initiative supported by policies of the federal and provincial governments.

and vegetables: they raise the returns to inputs; have high multiplier effects; generate employment; reduce seasonal variability and the price; and improve nutrition. There are big challenges as well. In the context of Punjab, while the production of fruits and vegetables has been rising far more rapidly than other crops there has not been a concomitant increase in their productivity levels because of inadequate development of a domestic seed industry—most of the good seed of vegetables is imported—poor on-farm practices, significant post-harvest losses on the farm and in the delivery chain to markets, lack of proper grading and standardisation (especially of fruits), excessive number of intermediaries between the producer and consumer, excessive government control in the marketplace, and under-investment in providing cold chains and processing raw products.

The marketing system for crop output is a legacy of the past in which all agricultural produce must go through the *mandi* owned by the provincial government and controlled by its agents and the 'elected' market committee. There are about 332 *mandis* and 135 market committees in Punjab under The Punjab Agricultural Produce Markets Ordinance of 1978 (amended after the 'devolution' in 2002).³⁹ Traders (buyers and sellers) of fruits and vegetables are not allowed to operate outside the government-owned and controlled *mandi*: this public monopoly has resulted in too many intermediaries with their respective margins at each stage.⁴⁰ It seems that the major intermediaries – contractors, commission agents, and wholesalers (see figure 1) – together with government officials and the elected market committee members engage in collusive behaviour and compete for rents generated by various means. It is estimated that the intermediaries take about two-thirds to three-quarters, if not more, of the price paid by the consumer. In the existing system the process of price formation is opaque and discriminates against the grower.

³⁹ The interesting thing is that while the provincial government controls the *mandi*—the district government organises the election of members for the market committee—it must depend on the independent local police for enforcement of the provincial rules and regulations about encroachments, sanitary conditions, etc. It is well known that the elections for the membership of market committee are not transparent or conducted fairly.

⁴⁰ There is good evidence that, contrary to the regulations, traders and processors are able to buy directly from growers, but their share in the total trade of fruits and vegetables is not known.

Figure 1: Market Channels for Fruits and Vegetables

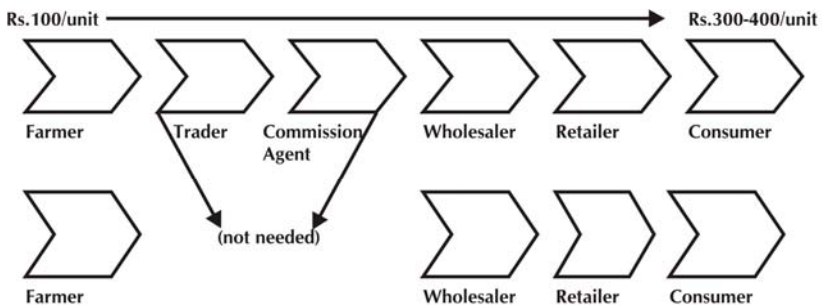
A good way to reduce the margins and pass on the benefits to the grower and consumer, and reduce the well-known malpractices in the government-controlled (in fact owned) *mandis* is to allow entry to the private processor, wholesaler or retailer to organise the trade directly with the farmer (Box 1). The government's role should be to make sure that the rules of fair play are observed: competitive behaviour, proper standards and grades, weights and measures, health and safety, etc. Government of Punjab should move away completely from its direct involvement in the business of controlling markets for agricultural produce: let a well-regulated private market system work so that the farmer and consumer are not penalised. A smaller number of intermediaries—two of them will disappear—will have the incentive to make the system more efficient and invest in the prevention of post-harvest losses and improvement in the quality of the standardised produce at consumer's end. It is likely to help producers, especially small growers, to organise as well. This will help them develop their bargaining power and reap the economies of scale. The government's primary role should be to regulate the markets, create incentives for the market players to invest in storage, transport and processing, and help the producer and consumer to get timely access to price information.

Box 1

“Revamped Farm Produce Supply Chain” in India

The traditional farm produce supply chain—farmer, trader, commission agent, wholesaler, retailer, and consumer—was created by the colonial government under the Agricultural Produce Marketing Committee (APMC) Act. Under the APMC Act—very similar to the existing Act in Pakistan Punjab—the state (provincial) government established *mandis* in various cities and towns. The wholesaler or retailer was prohibited from buying the farm produce from any place other than the government-owned *mandi*. This rule also applied to the farmer who had to sell all his produce through an authorised *mandi* auction. Where the state government allowed transactions outside the *mandi*, the buyer had to pay a *mandi* tax. The trader and commission agent often short-changed the farmer through improper grading and weighing of his produce and took advantage of the asymmetry in the information about price. In addition, the poor quality of administration increased the cost of trading. The long supply chain was inefficient, with high spoilage, and cumbersome, which added to the price at each stage: farmer, processor and consumer ended up paying for the market inefficiencies.

In 2003 Government of India proposed an amended (model) APMC Act which has been adopted by over two-thirds of the Indian states. The two key provisions of the amended act are: (i) allow the retailer or processor to buy directly from farmer to avoid or bypass the long chain of intermediaries and (ii) allow contract farming. In contract farming, a buyer can directly contract in advance to buy the produce from the farmer or lease the farm land and grow the produce: it means that the farmer would know about the price and quantity in advance. The amended act enables at the back end the processor to buy produce directly from the farmer and at the front end the processor can supply goods directly to the wholesaler or retailer without the intermediate steps for central storage and reliance on distributors. The effect of the amended act on the long chain is depicted below.



Adapted from Kumar et.al. (2008)

3.4.2. *Livestock and Livestock Products*

In most areas of irrigated Punjab, livestock husbandry is closely integrated with crop production. The primary purpose of livestock is to meet the dietary needs of the household, generate income from livestock products, provide draught power, and help the household to cushion economic shocks. The herds are generally small and depend largely on the local supply of fodder, grazing grounds, and the farm and household waste products. In spite of considerable integration into the market economy, the small-size herds of ruminants and flocks of poultry provide a small proportion of output for sale. It is estimated that only 30-40 per cent of milk ever enters the market. The exceptions to this general pattern are the large flocks of mainly small ruminants, commercialised poultry production, and peri-urban milk-production farms and units. In the case of large ruminants, milk is the most important product, particularly of buffalo, followed by meat as a by-product: animals not fit for dairy—very young male calves, dry buffaloes and cows, and sick animals—are slaughtered for meat. The main purpose of small ruminants, goats and sheep, is to get meat and hides and wool as the main by-products. In the last twenty-five years, the production and marketing of poultry products have gone through a major transformation, particularly in towns and cities throughout Pakistan. Their effects are well reflected in the relatively cheaper meat—poultry is the cheapest converter of feed into meat—and eggs. Most of this development has been due to the private initiative, facilitated by prudent public policy. This is, however, not the case for livestock.

The success in developing an efficient and profitable livestock system depends on four legs: breed, feed, health, and trade. Traditionally almost all of the focus, at least in the public sector, has been on the health of animals. There has been little progress in improving the genetic stock by selective breeding and hybridisation, of some of the potentially productive indigenous breeds of cattle and buffalo. In Punjab, the government-owned breeding farms—18 of them with 30,000 hectares of land—have made little headway in preserving and improving the indigenous breeds and providing the support needed in the private sector to engage in commercial breeding. Apparently there is no regulatory framework for breeding: a draft has been submitted recently for government approval. There are four semen production units in the public and five in the private sector, but an organised system of artificial

insemination based on proven progeny has not been developed so far. Breed improvement is the building block for a vibrant and productive livestock industry and the primary task of the government should be to provide a regulatory framework and proper incentives to the private sector to develop a commercialised breeding network in the province.

The state of feeding animals is perhaps even less healthy since a vast majority of livestock holders, owners of small herds in particular, depend on open grazing grounds—not many communal rangelands have been left in the plains—some fodder crops (millet and sorghum and legumes), wheat straw and the like, some grain, but with little protein-rich feeds such as oil cakes. The landless livestock holders are at a particular disadvantage since they must purchase the fodder and depend on others for grazing their animals. The livestock extension service has also not helped farmers about ‘balanced’ diet for their large ruminants given the resource constraints of most livestock holders: a general recipe is not good enough to prepare the animals for producing ample milk and meat even if they have the genetic potential.

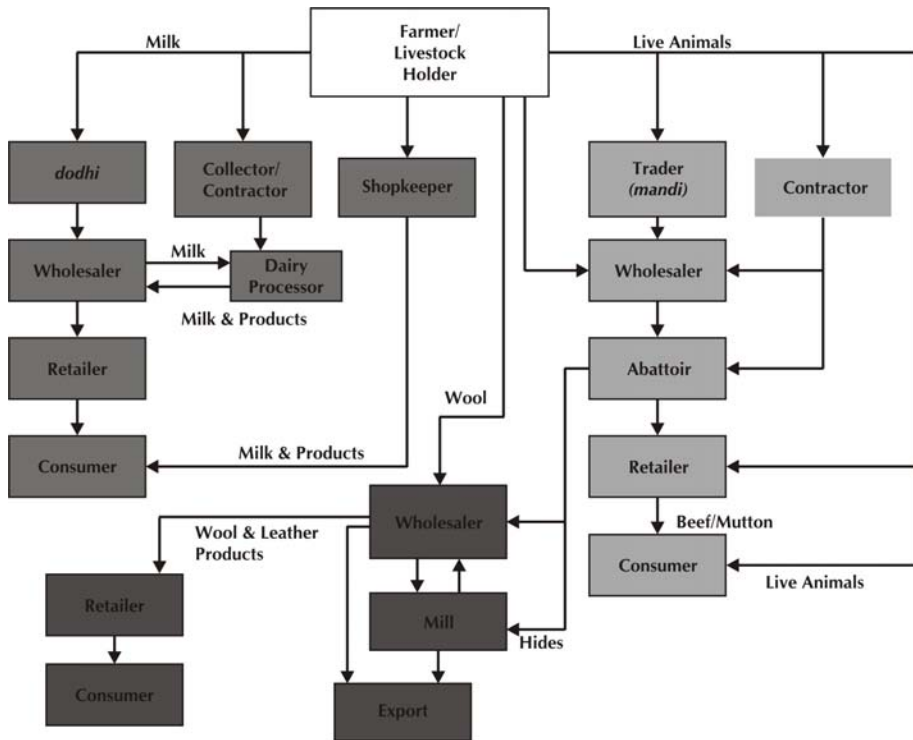
Meat

In Punjab there are two basic markets for livestock and its products (milk, meat, hides, and wool) – figure 2. The first one is for live animals and the other for milk and milk products.⁴¹ Live animals are bought and sold in thousands of open *mandis* controlled by the town and municipal committees. The space (ground) is auctioned annually by the local government to private contractors for which it charges them five per cent of the transactions. These contractors organise the *mandi* on a weekly, bi-monthly or monthly basis. Few if any *mandis* have the necessary facilities and support for the livestock and people involved in trading. The price for each animal is settled between the seller and buyer and the lots can range from one animal to many. Almost all of the bulk purchase is done by traders or contractors who transport the animals to abattoirs and peri-urban commercial dairy farms. Most animals bought for slaughter are young male calves, a vast majority younger than three months, dry (milch) cows or buffaloes, and the aged or sick animals. Since a large proportion of male calves are no longer required for draught power—tractors and tractor-driven trolleys have

⁴¹ A good account of the markets for livestock and its products in Pakistan can be found in Sharif et.al. (2003).

replaced them—a vast majority of livestock holders do not keep them for too long given the high opportunity cost.⁴² It is estimated that a substantial proportion of male calves die before the age of one year because of inadequate attention and care and about 30 per cent of them are slaughtered. Likewise, the peri-urban dairy farm owners tend to sell for slaughter the dry and diseased animals no longer considered profitable for milk. In Punjab, as in other areas of Pakistan, breeding and feeding animals primarily for meat has not developed as well as for milk and its products. Apparently some initiatives are under way to facilitate a large-scale commercial development of livestock for meat.

Figure 2: Market Channels for Livestock and Livestock Products



⁴² The Livestock and Dairy Development Board (LDDDB) of Pakistan has introduced a programme in which the livestock holders are given Rs.1,500 per animal if the young calf is fattened for six months or so. But this programme, like the other federal livestock programme, does not involve the provincial Department of Livestock and Dairy Development.

In spite of the rules and regulations of the provincial and local governments about the slaughter of animals, a vast majority (about three-quarters) of animals are slaughtered and their meat sold or disposed off without any supervision throughout the countryside and in towns. The Punjab Ordinance No.VIII of 1970 forbids unauthorised slaughter of animals and sale of meat without authorised stamp. There are two kinds of slaughterhouses in Punjab: about 180 abattoirs are owned by the local councils or municipal committees and the rest are privately owned and not regulated (unauthorised). The traders or contractors transport the animals from rural *mandis* by trucks in extremely stressful conditions, endured over long distances, to arrive at the authorised or unauthorised abattoirs.

The transported animals are lodged in open space, next to or near the authorised abattoir, controlled by wholesalers in collusion with the abattoir contractors. Here a hefty fee, often in excess of the official rate, is charged for each animal on entry and payments are also required for fodder and water given to animals and the boarding and lodging for traders if needed. By the time the animal is taken into the abattoir for slaughter, it increases in price by 40-50 per cent in addition to the loss in weight because of the trauma caused in transit. A government veterinarian is required to perform the ante-mortem and post-mortem examinations, but this is rarely the case in practice. It is also well known that water is pumped into the body of the animal when its throat is slit open to increase its body weight for sale as meat. Generally the slaughterhouse is controlled by a mafia-like group of contractors, in which butchers are well represented. Once slaughtered and its hide removed—hides are bought by traders and transported to factories—the animal is sold to buyers (mostly butchers) in lots of various sizes. The lots of slaughtered animals are transported to the butcher shop where the animal is dressed for sale to consumers. There is another 40-60 per cent margin added to the cost of meat between the abattoir and the butcher shop. An important point is that there is almost no official system of meat grading for the consumer who has to settle it with the butcher on one-to-one basis.

There are at least two important policy issues with regard to the marketing of live animals for meat. First, why should the government own and control the *mandi* for live animals and slaughterhouses? Apparently many of the so-called authorised *mandis* and slaughterhouses are operating as mafia-like businesses at the expense of the livestock holder and consumer. Why not allow the private sector to organise the *mandi* and

slaughterhouse and let the government regulate their operations. It will help reduce the number of intermediaries who skim part of the price at the expense of both the farmer (livestock holder) and consumer. Also, it will help reduce the long distances to which live animals must be transported and create incentives for the private sector to invest in transporting the product (meat) to the consumer market. Second, it should not be the business of the local or municipal government to 'cap' the price of meat, but to ensure that the product is being produced and sold under competitive and hygienic conditions while meeting the requirements of proper weights and standards at the wholesale and retail levels. The efforts to control prices in urban areas often result in shortages, adulteration and other similar commonly observed malpractices.

Milk

In Punjab, far more progress has been made in the operations of market for milk and milk products. However, it is estimated that about 70-80 per cent of the milk does not reach the urban market: some of the milk is wasted but most of it is fed to the suckling calves, consumed in the households of farmers and livestock holders, and sold at the retail level in the village. The largest share of the more organised market is controlled by the small-scale milk collectors (*dodhis*) who either sell the collected milk to wholesalers (or contractors) or directly to retailers for sale as fresh open milk—which accounts for 90 per cent of all urban milk supply—or processed for other products (sweets, yogurt, etc.). *Dodhis* were traditionally also lenders of money to the individual, small-scale, livestock owner, and kept the account for milk transactions. But this is changing, given the alternatives available to milk producers. The milk collected by *dodhis* and sold to consumers either through retail shops or delivered at the doorstep is adulterated (mixed with water, preservatives, and thickeners) and risky to consume without boiling (pasteurising) it at high temperature. The consumer is cheated on account of both quantity and quality for the price paid for milk. It is estimated that about 25-30 of the volume is added to milk with water, etc. at one stage or the other in the chain. Paradoxically the spasmodic campaigns of the local or municipal government to 'cap' the price of open milk in towns and cities work against the interest of the consumer.

The commercial dairy industry—now accounting for about 8 per cent of milk on the market—in Punjab takes two basic forms. In the first one, commercial processors of fresh milk (e.g. Nestle and Haleeb) buy milk

from the producer either directly through their agents or other milk collectors (contractors) including *dodhis*. The price paid to the producer is based on the non-solid fat (NSF) and fat contents of milk. Much of this milk is UHT treated or pasteurised—the former has a much longer shelf life—and packaged for sale through retail outlets. The rest is processed into powdered milk or other milk products (yogurt, ice cream, etc.).⁴³ One of the effects of milk collection by the commercial dairy industry is that the producer tends to get a better price than would normally be the case with the traditional *dodhi* alone in the market.⁴⁴ In addition, some of the commercial dairy enterprises have developed a package of services and support as incentives to improve the production system and assure reliable supply of milk throughout the year. An important point to add here is that the commercial milk processors are able to utilise only 50-60 per cent of the installed capacity.⁴⁵

The other model of commercial milk collection and processing is perhaps more interesting, especially from the point of view of small livestock holders. It is a vertically-integrated system of milk production, collection and processing operated by *Idara-e-Kissan*—registered under the Societies Act of 1870—since the early 1990s. Here milk producers form voluntary milk committees at the village level to collect and deliver milk to *Idara-e-Kissan* at prices, based on the NSF and fat contents, and settled in advance between the parties. The members have access to services of breeding (fresh semen and artificial insemination), health care of livestock, and feeds and fodders. Some services are provided on a subsidised basis or free and others on full payment. The purpose is to improve the genetic stock of animals and their productivity level for milk and meat. *Idara-e-Kissan* owns and operates milk processing plants to pasteurise milk, which is sold in (plastic) packets, make powdered milk, and yogurt. The integrated system has been expanded to seven districts and seems to work well to the advantage of both small-scale producer and consumer: it offers better price at both ends than the alternatives available to them (Riaz 2006).

⁴³ See: World Bank (2006) for a detailed analysis of the market chain and margins for powdered milk in Pakistan.

⁴⁴ A recent study of the commercial milk collection and distribution network in Punjab shows that the greater competition for milk in rural areas tends to help even small milk producers, though the large producers enjoy a clear advantage in terms of efficiency and economies of scale. See Burki and Khan (2008).

⁴⁵ Pakistan Dairy Development Company (2006).

At least three important issues are worth considering in the context of milk production and marketing. First, the federal government has undertaken a five-year (2006-07 to 2011-12) project for livestock improvement based on farmer organisations—along the lines of participatory community organisations in the rural support programmes—in all districts of Punjab. In this experiment, somewhat similar to what *Idara-e-Kissan* does, the approach is to establish commercialised ‘pockets’ of milk and meat by organising the small-scale farmers and livestock holders. These organisations are given access to small loans and receive support services on the production side, ranging from breeding to health care and feeding of animals, and establish links with the milk and meat marketing systems. The second issue, being debated across Pakistan, is about the passage of pasteurisation regulations for milk before it is sold to the consumer. It seems that at this stage this requirement is neither necessary nor can be met by most milk collectors and sellers.⁴⁶ What is needed is to reduce the room for adulteration in milk by (i) effective enforcement of the existing regulations, (ii) inducing greater competition in the marketplace, and (iii) introducing alternative methods of delivery to the consumer’s doorstep in urban areas. The local and municipal governments should be aggressive in fighting adulteration rather than putting price caps on milk. The outcome is likely to be far better if more support is given to the small-scale producers to organise and incentives for the milk collectors to compete for the quality and price of milk. Finally, in urban neighbourhoods, the private sector may find it worthwhile to deliver open milk, pasteurised or fresh, on wheels or at designated kiosks through self-operated machines in which the buyer pays exact amount for the desired volume of milk in his/her container. This seems to be working well in some cities in India. Why not try here?

4. Conclusion

Several important issues and questions about public policy to improve the performance of agriculture in irrigated Punjab submitted in this paper need to be analysed and examined more thoroughly. However, on some issues there is significant evidence about what is right or wrong with public policy. The paper can be concluded with the following propositions and questions that follow from it.

⁴⁶ Pakistan Dairy Development Company (2006).

Agricultural Land

1. Good farm land should be protected from its less agreeable alternative uses, especially around the periphery or in close proximity of the urban centres, by proper and enforceable zoning regulations.
2. Legislate private right to the ownership of agricultural land and enter into official record the title of the legitimate owner. It is absolutely essential to involve all stakeholders in the land survey (using the GIS) needed to resolve the competing claims on land in the existing land record.
3. It is important to find out why the pilot projects on the computerisation of land record in Punjab have not produced the anticipated results. What lessons have been learnt?
4. Protection of land quality should be high on the policy agenda: change the distorted price signals and similar policies that encourage farmers to use the input-intensive technologies.

Irrigation Water

1. Put in place a regulatory framework for the use of groundwater and enforce the rules to avoid overexploitation. Why not vest the ownership of groundwater with the state and give fair access to individuals on demand.
2. What lessons were learnt from the LCC East experiment of farmer-controlled canal irrigation system and how they have been incorporated in the new canal command areas? How does the new system compare with the government-controlled centralised canal irrigation system?
3. Introduce on a pilot basis a volume-based system of irrigation water supply starting at the tail-end of watercourses.
4. Management of water at the farm level must be improved by testing and disseminating technologies that take into account the economic and technical constraints of farmers and the small farmers in particular. Are the small farmers too far behind the large farmers in

the adoption process? What are the major reasons? How can their constraints be alleviated?

Crop Seeds

Given the importance of good seeds for crops and their limited use, the regulatory framework should create incentives for breeders in the private and public sectors and private suppliers of seed (produced locally or imported) and regulate the quality and safety aspects of seeds available to farmers in the marketplace. Too many controls create plenty of room for perverse (rent-seeking) behaviour.

Agriculture Research and Extension

1. Since good research and extension are important for the growth of a productive agriculture and farm incomes, and given the widespread doubts about the effectiveness of the existing agriculture research and extension services, it would be interesting to estimate the rate of return on public sector investment in these activities. Has the service been worth the public money spent on it?
2. How can (or should) the universities, provincial research and extension establishments and the private sector improve their collaboration to develop synergies?
3. The attempt to 'corporatise' the provincial research institutes should be done with great care because of the unresolved issues about the transfer of assets and liabilities and the selection of research staff.
4. Is the bifurcated system of extension service in crops and livestock the best way to transmit new technologies and messages to the farmer? Should the extension system not transform itself into a specialised service given by both the public and private sectors? Should the system not use a localised adaptive-research method in which the service interacts with the farmer through focus groups (e.g. Farmer Field Schools or Village Organisations) served by skilled professionals with the support of teams of research specialists?

Markets for Agriculture Products

1. The government monopoly on markets (*mandis*) for agriculture produce (e.g. fruits and vegetables) should be terminated and the private sector be allowed to establish regulated markets to reduce the number of intermediaries and their margins. The government should concentrate on providing a fair playing field to the buyer and seller and regulate the quality, standards and grades, and safety of the produce.
2. A similar approach is needed in the selling and buying of live animals and slaughter of animals. Government should not own the *mandis* for live animals and abattoirs, but regulate them well: let the private sector do its business. In fact, the government should give material incentives and facilities to the livestock holders and private investors to develop livestock pockets in the rural areas where the animals are kept by millions of small livestock holders.
3. Finally, governments should not be capping the price of milk or meat in the urban areas since it either raises the price, or reduces the supply, or encourages malpractices (adulteration, etc.).

Information and Data

1. Since government agencies collect and keep almost all of the information and data related to various aspects of crops, livestock and irrigation, it is necessary to improve their quality by involving other stakeholders in the planning, designing and collection processes. Data verification should be a continuous process.
2. Government should remove all legal and administrative barrier for access to information and data—make them available on demand—which are of public interest.

Appendix

Table 1: Share of Agriculture, Livestock and Irrigation in Provincial Expenditure, 2003-08

Expenditure	2003-04	2004-05	2005-06	2006-07	2007-08	Average
Current	5.5	5.5	5.5	4.7	4.3	4.9
Development	10.2	11.2	9.0	6.7	9.5	8.9
Total	6.4	7.0	6.5	5.4	6.4	6.3
Average Growth Rate (2003-04 = 100)						
Expenditure on A,L and I		22.1	6.5	10.7	31.7	17.9
Total Provincial Expenditure		11.6	9.4	33.2	11.2	16.4

Source: Provided to the Author by Government of Punjab, Department of Finance. The data for 2007-08 are based on budget estimates.

Table 2: Expenditure on Agriculture, Livestock and Irrigation in Punjab, 2003-08

(Million Rs.)

Expenditure by Sub-sector	2003-04	2004-05	2005-06	2006-07	2007-08 ¹	Total	Average
Current Expenditure	6751	7340	8655	9662	10439	42847	8570
Agriculture	1814	1945	2466	2500	2686	11411	2282
Livestock	675	713	786	910	960	4044	809
Irrigation	4262	4682	5403	6252	6793	27393	5479
Development Expenditure	2790	5389	5979	7713	15867	37738	7548
Agriculture	948	2424	1066	1375	3286	9099	1820
Livestock	148	277	812	1207	1431	3875	775
Irrigation	1695	2688	4101	5130	11150	24764	4953
Total Expenditure	9541	12729	14634	17375	26306	80585	16117
Agriculture	2762	4369	3532	3875	5972	20510	4102
Livestock	823	990	1598	2117	2391	7919	1584
Irrigation	5957	7370	9504	11383	17943	52157	10431
Total Provincial Expenditure	149387	182214	224595	321000	410321	1287517	257503
Current	121999	133987	158271	205838	243487	863582	172716
Development	27388	48227	66324	115163	166834	423936	84787

Source: Provided to the Author by Government of Punjab, Department of Finance. The data for 2007-08 are based on budget estimates.

References

- Ali, Mubarik (2007). "Horticulture Revolution for the Poor: Nature, Challenges and Opportunities." Background Paper for the *World Development Report 2008*. Mimeographed.
- Ali, Mubarik and Derek Byerlee (2000). "Productivity Growth and Resource Degradation in Pakistan's Punjab: A Decomposition Analysis." Policy Research Working Paper No. 2480. Washington, D.C.: The World Bank.
- _____ (2004). "Accelerating Agricultural Growth in Punjab: Priorities for Public Policy." Report for the *Punjab Economic Report 2005*. Lahore.
- Ali, Mubarik and Mohammed Ashraf (2007). "National Strategic Direction for Agricultural Research in Pakistan." Report for the Pakistan Agricultural research Council and Asian Development Bank. Islamabad.
- Berdegue, Julio A., et. al (2008). "Innovative practice in connecting small-scale producers with dynamic markets." *Regoverning Markets Innovation Practice Series*. London: International Institute for Environment and Development.
- Burki, Abid A. and Mushtaq A. Khan (2008). "Food Supply Chains and Smallholder Efficiency in Developing Countries: Evidence from a Natural Experiment." Lahore: Department of Economics, Lahore University of Management Sciences. Mimeographed.
- Dixon, John and Aiden Gulliver (2001). *Farming Systems and Poverty: Improving farmers' livelihoods in a changing world*. Rome: FAO and World Bank.
- Government of Pakistan (1972). *Pakistan Agriculture Census 1972*. Statistics Division, Lahore: Agriculture Census Department.
- _____ (1986). *Livestock Census 1986*. Statistics Division, Lahore: Agriculture Census Department.
- _____ (1996). *Livestock Census 1996*. Statistics Division, Lahore: Agriculture Census Department.
- _____ (2000). *Pakistan Agriculture Census 2000*. Statistics Division, Lahore: Agriculture Census Department.

- _____ (2006). *Livestock Census 2006*. Statistics Division, Lahore: Agriculture Census Department.
- _____ (2007a). *Agricultural Statistics of Pakistan 2006-07*. Ministry of Food, Agriculture & Livestock, Islamabad: Economic, Trade & Investment Wing.
- _____ (2007b). *Pakistan Economic Survey 2006-07*. Finance Division, Islamabad: Economic Advisor's Wing.
- _____ (2008). *Pakistan Economic Survey 2007-08*. Finance Division, Islamabad: Economic Advisor's Wing.
- Government of Punjab (2004). *District-Based Multiple Indicators Cluster Survey 2003-04*. Lahore: Planning and Development Department.
- _____ (2005). *Punjab Economic Report*. Report No. 29373-PAK. Lahore: Planning and Development Department.
- _____ (2007). *Punjab Economic Report 2007*. Punjab Economic Research Institute, Lahore: Planning and Development Department.
- _____ (2008). *Scheme for transfer of Irrigation Management: Farmers Organisations in Punjab*. Punjab Irrigation and Drainage Authority, Lahore: Irrigation and Power Department
- Jamal, Haroon (2007). "Income Poverty and District Level: An Application of Small Area Estimation Technique." Research Report No. 70. Karachi: Social Policy Development Centre.
- Khan, Mahmood Hasan (2006). *Agriculture in Pakistan: Change and Progress 1947-2005*. Lahore: Vanguard Books.
- _____ (2008, April 17). "Fudging the Numbers." Karachi : The DAWN. <http://www.dawn.com/2008/04/17/op.htm>
- Kumar, Vijay, Patwari, Yogesh and Ayush H. N. (2008). "Organised Food Retailing: A Blessing or a Curse?" *Economic & Political Weekly*. May 17, 2008. pp.67-75.
- Malik, Sohail J. (2005). *Agricultural Growth and Rural Poverty: A Review of Evidence*. Working Paper No.2. Islamabad: Asian Development Bank Resident Mission.
- Nadeem, Arif and Asrar-ul-Haq (2008). "Punjab Irrigation Sector Reforms Program – Strategic Interventions and Reforms Management." Lahore. Mimeographed.

- Pakistan Dairy Development Company (2006). *The White Revolution—“Doodh Darya”*. White Paper on Pakistan’s Dairy Sector. Lahore.
- Riaz, Khalid (2006). “Analyzing Success Stories in Agricultural Development in Pakistan: Case Studies.” Islamabad. Mimeographed.
- Rodrik, Dani (2008, March 26). *Thinking about governance and getting a headache* message posted to <http://ksghome.harvard.edu/~drodrik/Thinking%20about%20governance.doc>
- Sharif, M., W. Malik, N. I. Hashmi and U. Farooq (2003). “Action Plan for Livestock Marketing Systems in Pakistan.” Islamabad: Social Science Institute (NARC) and FAO. Mimeographed.
- World Bank (2004). *Pakistan Rural Factor Markets: Policy Reforms for Growth and Equity*. Report No. 30381-PK. Washington, D.C.: The World Bank.
- _____ (2005a). *Agricultural Growth for the Poor: An Agenda for Development*. Washington, D.C.: The World Bank.
- _____ (2005b). *Pakistan: Country Water Resources Assistance Strategy*. Report No. 34061-PK. Washington, D.C.: The World Bank.
- _____ (2006). *Pakistan: Growth and Export Competitiveness*. Washington, D.C.: The World Bank.
- _____ (2007). *Pakistan: Promoting Rural Growth and Poverty Reduction*. Report No. 39303-PK. Washington, D.C.: The World Bank
- _____ (2008). *World Development Report: Agriculture for Development*. Washington, D.C.: The World Bank.

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