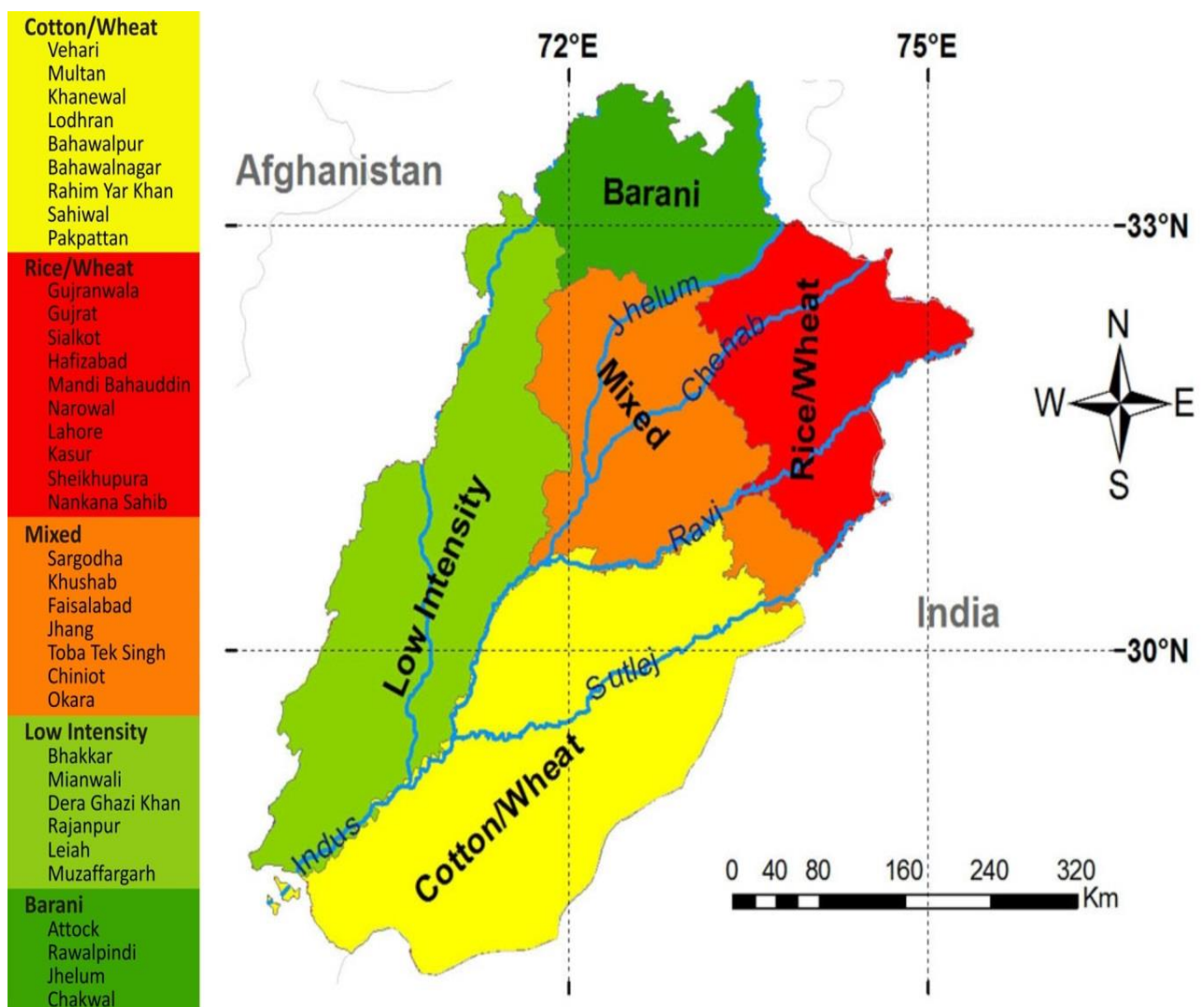




Punjab Agriculture Policy 2017



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Acronyms and Abbreviations

AARI	Ayub Agriculture Research Institute
AE&AR	Agriculture Extension and Adaptive Research
ADP	Annual Development Program
ADU	Agriculture Delivery Unit
APMs	Agricultural Produce Markets
ATI	Agriculture Training Institute
BOG	Board of Governors
BT Cotton	Bacillus Thuringiensis Cotton
CAPP	Connected Agriculture Platform Punjab
CEO	Chief Executive Officer
CPEC	China Pakistan Economic Corridor
CRS	Crop Reporting Services
CSA	Climate Smart Agriculture
CSD	Canteen and Stores Department
DG	Director General
EPA	Environmental Protection Agency
FAO	Food and Agriculture Organization
FD	Finance Department
FSC&RD	Federal Seed Certification and Registration Department
GDP	Gross Domestic Product
GHG	Green House Gas
GoPunjab	Government of Punjab
HEC	Higher Education Commission
HEIS	High Efficiency Irrigation System
HIES	Household Integrated Economic Survey
HQ	Head Quarter
ICT	Information and Communications Technology
ICSA	Institute of Climate Smart Agriculture
IT	Information Technology
IFPRI	International Food Policy Research Institute
KPI	Key Performance Indicator
LSTI	Livestock Training Institute
M&E	Monitoring and Evaluation
MICS	Multiple Indicator Cluster Survey
NARC	National Agricultural Research Center
NGO	Non-Governmental Organization
OFWM	On Farm Water Management
PAD	Punjab Agriculture Department
PAMRA	Punjab Agricultural Marketing Regulatory Authority
PARB	Punjab Agricultural Research Board
PARC	Pakistan Agricultural Research Council
PBIT	Punjab Board of Investment and Trade
PC	Performance Contracts
PID	Punjab Irrigation Department
P&D	Planning and Development

PEEP	Punjab Enabling Environment Project
PHRDC	Punjab Horticulture Research and Development Corporation
PSC	Punjab Seed Corporation
QPR	Quarterly Performance Review
R&D	Research and Development
SCF	Small Commercial Farmers
SMART	Strengthening Markets for Agriculture and Rural Transformation
TFP	Total Factor Productivity
USAID	United States Agency for International Development
WFP	World Food Program

Punjab Agriculture Policy 2017

EXECUTIVE SUMMARY

The Department of Agriculture defines its vision as “Transforming the agriculture sector into a diversified, sustainable, modern and market-driven sector through ICT empowerment, efficient resource utilization and revamping existing practices.” The proposed transformation will take the agriculture sector of Punjab from a low growth rate to a sustainable 5.1 percent rate based on a) increased profitability and b) ICT led farmer-centric service delivery. This focus requires improvement in productivity through higher and less variable yields, better functioning markets, the use of productivity enhancing inputs and better and predictable prices for outputs. The existence of climate change and its strong effects on production and water use, the obligation of agriculture in Punjab to help reduce malnutrition, and the role of the sector in poverty reduction are some of the broader challenges that are addressed in the 2017 Punjab Agricultural Policy.

The Punjab Agriculture Policy 2017 presents ways forward in two broad areas, guiding principles and cross cutting themes that need to be included in all efforts, and then a set of specific initiatives. There are three major guiding principles: a consideration of the role of government in a market-oriented sector, where they refrain from direct activities in production, marketing and distribution, which are left increasingly to the private sector; the central and ongoing need for capacity building, which includes both training as well as strengthening the institutions within PAD; and a call for attention to linkages across departments and with external stakeholders. The linkages must be cultivated for coordination between programs and policies across departments, but more importantly to develop an analytical capacity in PAD to argue on behalf of farmers with other departments and ministries.

Then three groups are identified that need to be included in all initiatives, which include the small commercial farmers, women in agriculture, and unemployed rural youth. The “Small Commercial Farmers” are operators between 3 and 75-acres and have the capability to take risks, adopt and adapt technology, and have the largest production and consumption multipliers for overall growth and poverty reduction. An empowered female labor force will raise agriculture production and affect food security and the nutrition status of children, while the so-called youth bulge is leading to many unemployed but educated rural youth, who could, with the right incentives, contribute to the development of a modern agricultural system.

Six major institutional structures are proposed within the Policy initiatives to address important issues in the sector. They are each designed to increase coordination, raise visibility of the issues and add technical and financial capacity in the relevant area. These include a Punjab Seed Certification and Registration Authority, an Institute for Climate Smart Agriculture (ICSA), the establishment of an Agricultural Marketing Regulatory Authority (PAMRA), a Punjab Horticulture Research and Development Institute (PHRDI), an Agribusiness and Innovation Fund, and Directorate of Human Resource and Capacity Development, along with the governance structures. Other programs are also included in the Initiatives discussions, and are outlined in detail in the attached Policy Matrix.

The Policy also highlights the need for a Monitoring and Evaluation platform, which provides the ability to learn from what has worked and what has not, along with an institutional structure that facilitates this change.

INTRODUCTION

The Department of Agriculture defines its vision as:

“Transforming the agriculture sector into a diversified, sustainable, modern and market-driven sector through ICT empowerment, efficient resource utilization and revamping existing practices”

The proposed transformation in this vision is expected to take the agriculture sector of Punjab from the current low 2.1 percent growth rate to a sustainable 5.1 percent based on a) increased profitability and b) Information and Communication Technology (ICT) led farmer-centric service delivery.

The focus on profitability of agriculture requires improvement in productivity through higher and less variable yields, better functioning markets, the use of productivity enhancing inputs and better and predictable prices for outputs. Success in this outcome is predicated on a) reform of the research and extension system and b) addressing weaknesses in the agricultural sector’s input and output markets. To achieve these ends, the Agriculture Department is retooling itself to be an ICT led, farmer centric organization providing improved service delivery and evidence-based, diagnostic-driven extension services to 5 million farm families in Punjab. As part of this effort, it also aims to mobilize PKR 75 billion in private investment to meet its overall objectives. This is a huge but surmountable challenge.

A series of challenges were also recognized by Punjab Agriculture Department (PAD) as being central to the shift to a private sector and modern agricultural system. The shift to more private sector agriculture also must be supported by significant improvements and supporting development in the agricultural value chain, including its agricultural marketing system. If these output market institutions work properly, the scope for a more diversified and higher valued agriculture can grow. On the input side, a private sector agricultural mechanization industry must develop, and the markets for seed, labor, water and land must be improved and send appropriate signals on scarcity and value of the resources and inputs. Additionally, the existence of climate change and its strong effects on production and water use, the obligations of the agricultural system in Punjab to contribute to a reduction in malnutrition, and the role of the sector in poverty reduction are some of the broader challenges that need to be addressed as the sector progresses.

The move from a traditional to a modern agriculture and to efficient resource-utilization requires revamping of long entrenched practices: changing the way markets and institutions work; and, creating new attitudes and behavior of agents so that they can respond a new set of incentives and signals. This also entails the need for a science-based agricultural policy that is built on a Research, Monitoring and Evaluation platform, which provides the ability to learn from what has worked and what has not, along with an institutional structure that facilitates this change.

The Punjab Agriculture Policy 2017 presents a structure and guiding principles that can enable these changes. The context of agriculture in the Punjab is first presented to complete this introductory section, which is followed by a major section outlining the guiding

principles and cross cutting themes that must be reflected in all actions taken. Then, specific areas of emphasis are reviewed, which are examined in terms of the key changes required in the output and input markets, and then selected areas related to the broader challenges. The Policy concludes with a summary of the main institutional changes needed and how change can be managed. A more specific presentation of the initiatives is in the Policy Matrix at the end of the document.

Agriculture in Punjab and the need for an Agricultural Policy

Agriculture and livestock in Punjab contribute 27% to provincial Gross Domestic Product (GDP), account for more than half of agriculture's share in the nation's GDP, and make up a substantial share of national export earnings. Agriculture in Punjab is responsible for two-thirds of the country's total food production, and thus plays a key role in food security. The sector's share in total value added generated in Punjab is only about 20 percent, but it employs over 40 percent of the labor force. Therefore, overall productivity of labor in agriculture is significantly lower than in other sectors, and as a result, poverty in the sector is stubbornly high.

Punjab consists of about 27 million acres of fertile irrigated area, with diverse natural resources and climatic conditions, which are highly suitable for a diversified and productive agriculture. Yet 90% of cultivated land is under five major crops: wheat, rice, cotton, sugarcane, and maize, leaving only about 10% for horticulture and other high value crops. Over time there has been little or no diversification away from these crops. Overall productivity is low and large gaps exist between average yields, progressive farmer yields, Punjab's potential and the world's best averages, as seen in Figure 1. The progressive farmers in the province produce around twice the yields as the average farmer (and over three times in wheat), and in sugarcane, cotton and rice, progressive farmers are approaching the world's best averages.

Total Factor Productivity (TFP) in agriculture is currently the lowest in the region; and, it has been declining since the 1980s, the so-called golden period of Pakistan's agriculture¹. Not only is aggregate TFP low and declining but the aggregates mask large variations across regions and size of farm categories, many of which are worse off than the average in a slowing TFP. While TFP has been stagnant, growth has come mostly from greater input use rather than technological change or better practices. Factors contributing to this decline include a lack of new seed varieties, resistance of pests to existing pesticides, stagnant irrigation methods, decreasing soil health resulting from poor farming practices, as well as deficiencies and imbalances in fertilizer use and a failure to leave the land fallow.

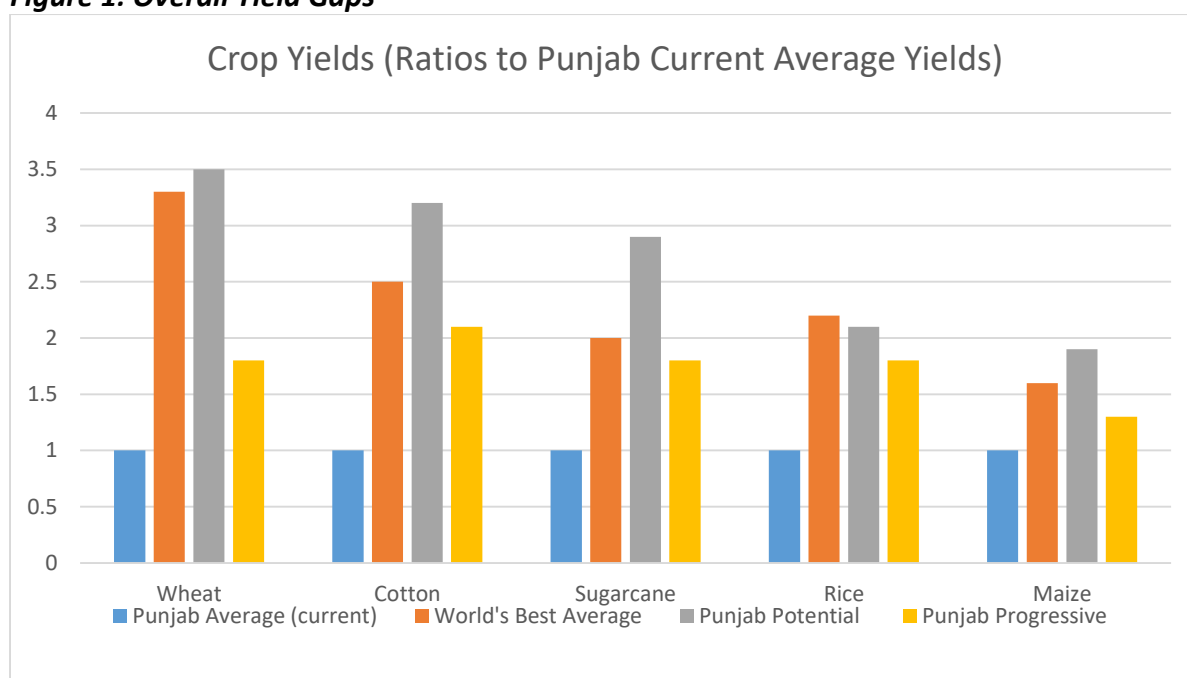
In the 1960 Agriculture Census, only 19 percent of all farms were under two hectares. In the 2010 Census, these had increased to 67 percent. The average size of farm in these under-two-hectare farms is about one hectare, with an average number of 2.6 fragments in each

¹ Malik, Sohail Jehangir; Ali, Shujat; Riaz, Khalid; Whitney, Edward; Malek, Mehrab; and Waqas, Ahmad. 2016. Agriculture, land, and productivity in Pakistan. In *Agriculture and the rural economy in Pakistan: Issues, outlooks, and policy priorities*. Spielman, David J.; Malik, Sohail Jehangir; Dorosh, Paul A.; and Ahmad, Nuzhat (Eds.). Chapter 2. Pp. 41-80. Philadelphia, PA: University of Pennsylvania Press on behalf of the International Food Policy Research Institute (IFPRI).

farm. This average size of farm is NOT viable for the technology being practiced in the traditional farming practices².

At an estimated poverty rate of 42.6 %, Punjab is home to the highest absolute number of poor people in the country and has driven most small farmers to diversify substantially out of farming and seek additional sources of income merely to subsist. For farm households up to 3 acres, crop income is now less than half of total household income. There are variations across regions, and the more disadvantaged regions are also more affected, as poverty in the mixed cropping zones within these small farms is 32%, while in the cotton/wheat zone the rate reaches 64%. Beyond just small size, these poor farms see high levels of illiteracy, and a lack of access to credit and better markets, which become critical constraints to the adoption of technology. Thus, most such farmers cannot take risks associated with modernization and make a move to high value crops.

Figure 1: Overall Yield Gaps



As the size of an economy grows, the relative share of agriculture's contribution declines, as does its influence over rural livelihoods and poverty reduction. However, research shows that agriculture growth is still the main mechanism for inclusive poverty reducing growth in Pakistan; not only to ensure food and nutrition security, but also to boost the economy and generate incomes and demand for local goods and services. Analyses show that this inclusive growth can still be generated by focusing on farm categories between 3 to 75 acres in Punjab, a perspective that underlies the activities proposed in this Policy.

With low productivity growth, prices of essential commodities tend to be high, leading to low affordability, and incomes derived from agriculture are low. The key to unlocking growth in food availability and diversity thus lies in a thriving agriculture sector with

² See Mellor, J. W. and S. J. Malik. 2017. "The Impact of Growth in Small Commercial Farm Productivity on Rural Poverty Reduction." *World Development*, 91: pp. 1–10.

sustainable productivity and a diversity of output, which can keep up with the growing population and can create the broader benefits that come from the close ties between agriculture growth, food security and poverty. Sustainable agriculture growth will increase supply and reduce the price of more a diverse and nutritious set of foods, thereby benefiting the poor and promoting inclusive growth.

Achieving food security through self-sufficiency in food grains, especially wheat, has long underpinned sector policies, investment priorities and public expenditures. However, food security is not just about production and availability, but includes four components, i.e. availability, accessibility, utilization and sustainability. Food insecurity in Punjab remains high. Data suggest that 37% of households in Punjab, and more than half of households in certain divisions, are consuming less than the recommended average daily number of calories³. Food based nutrient intake inadequacies are also high and range from 23% for protein to 67% for vitamin A⁴. Two out of every three households are unable to afford a nutritious diet with current food expenditures⁵. With this situation, it is not surprising that one in ten⁶ children in Punjab dies before the age of five, and one out of every three⁷ that survive is stunted and/or underweight.

The 2017 policy provides the framework to catalyze inclusive growth by capitalizing on the vast potential in Punjab's natural and human resources, and by using a science based approach to learning with the intent of replication and upscaling. It defines the set of actions to be taken to ensure achievement of the Vision of a "diversified, sustainable, modern and market-driven sector," with steps to be taken in the short to medium term. With success, significant gains in food security, poverty reduction, and a profitable and flourishing agriculture in Punjab

GUIDING PRINCIPLES AND CROSS CUTTING THEMES

This Policy focuses on the critical steps necessary for the Punjab Agriculture Department (PAD) to begin a process of sustained profitability increases, diversification and enhanced food security. There are three major guiding principles: a consideration of the role of government in a market-oriented sector, where they refrain from direct activities in production, marketing and distribution, which are left increasingly to the private sector; the central and ongoing need for capacity building, which includes both training as well as strengthening the institutions within PAD; and a call for attention to linkages across departments and with external stakeholders. The linkages must be cultivated for coordination between programs and policies across departments, but more importantly to develop an analytical capacity in PAD to argue on behalf of farmers when different policies and programs are proposed outside of PAD itself, such as the effects of taxes and subsidies, or changing exchange rate regimes.

³ GoP (Government of Pakistan) 2017. Food Security Assessment Report. Islamabad: Ministry of National Food Security and Research. Forthcoming

⁴ Ibid.

⁵ GoP (Government of Pakistan) and WFP (World Food Programme). 2016. Minimum Cost of the Diet–Pakistan. Islamabad: Ministry of Planning Development and Reforms, Planning Commission and World Food Programme.

⁶ MICS (Multiple Indicator Cluster Survey). 2011. Monitoring the situation of children and women, Lahore: Bureau of Statistics, Government of Punjab. (<http://bos.gop.pk/finalreport> Accessed 05 June, 2017)

⁷ MICS (Multiple Indicator Cluster Survey). 2011. Monitoring the situation of children and women, Lahore: Bureau of Statistics, Government of Punjab. (<http://bos.gop.pk/finalreport> Accessed 05 June, 2017)

Then three groups are identified that need to be included as specifically as possible in all initiatives. These are the small commercial farmers, women in agriculture, and unemployed rural youth.

The Role of Government

The role of government in agriculture within a market-oriented sector envisioned in this policy is vital and needs to be set forth at the beginning. Under such an economy, governments refrain from direct activities in production, marketing and distribution, which are left increasingly to the private sector. Government's role, however, is still critical: to provide policy and support that guides the private sector and civil society towards broader social goals; to evaluate and revise strategies and policies; to create an enabling environment, public infrastructure and regulatory enforcement; and, to consider social needs, the environment and other externalities. To pursue these goals, the government should focus on several themes: information provision; financing and encouraging research and public good investments, while also coordinating, monitoring and evaluating them; and facilitating civil society and the private sector.

Policies and strategies can only be successful if there is timely and sufficient information. A statistically valid and independent market information system is needed to collect and disseminate timely data, which should include a crop forecasting system, the capacity to analyze domestic and international demand, and stocks available for export or imports needed to meet domestic shortages. Data collection, analysis and dissemination must be sufficient to understand differing challenges to agriculture within disaggregated crop zones and districts. Analytical products, such as market outlook, cost of production studies, and the assessment of costs of regulation should be regular parts of information provision. This timely information can help price stabilization policies, reduce distortions in trade, and determine fair prices. Such analyses are also essential for the targeting of subsidies where subsidies are essential.

The public agricultural research system is central to the generation of technologies on which production diversity and resource conservation will depend. In addition to the generation of agricultural science innovations, the system must also provide options for development of China Pakistan Economic Corridor (CPEC) related clusters, and regulatory reviews to assist value chain development, among many other areas. The decision-making process should use science based policy research and adopt strategies to move away from a one size fits all approach, and so maximize on the potential gains from vertical and horizontal linkages.

Effective policy development requires communication and coordination with all stakeholders, including consumers and producers, agencies and agriculturally-related departments involved in production, input delivery, and marketing and processing. Furthermore, efficient points of interface in PAD with farmers, planners, the private sector, and Non-Governmental Organization (NGOs) need to be developed and maintained. Effective policy implementation also involves providing an interface with international stakeholders – donors, research institutions and businesses to protect the interests of the small and remote Punjab farmers, and works with other Punjab institutions to ensure a level playing field.

The development of agriculture in Punjab is affected by other policies and strategies of the GoPunjab. The most obvious interface is with the Departments of Livestock and Dairy Development, Food, Environment, Irrigation, and Cooperatives. However, many linkages exist with Industries, Commerce and Investment, Forestry Wildlife and Fisheries, Labor and Human Resources, Women Develop

The 2017 Agricultural Policy of Punjab proposes a series of programs, investments and institutional development that will move the Government of Punjab (GoPunjab) towards these roles.

Capacity Building as a Core Program

The science based approach needed to drive a modern agriculture requires building capacity at all levels of the value chain, within each government initiative, and needs to make use of, and expand, a core of technical knowledge. That core must be beyond just the production sciences, and should include skills in communication, ICTs, business and marketing, and should grow in response to stakeholders' needs. Capacity building will address two different components: (1), developing ongoing and state of the art training programs so that all employees have the potential to improve delivery of their programs; (2) strengthening the authorities and wings to do their missions. Regarding (1), of course most capacity building involves training individuals to do their jobs better. This requires getting the right people in place, with the correct education and background to be successful. Beyond that, of course, all staff need skills upgrading as demands change and as scientific progress is made. However, just feeding information to staff is insufficient, so targets for training outputs need to be SMART (specific and measurable, achievable, results oriented, and time bound), so that real usable capacities come from training. Follow on review, and attention to impacts are necessary.

While training institutes exist in the Punjab, and have for many years, an emphasis on new skills appears to be lacking in the Director General (DG) Agriculture Extension and Adaptive Research(AE&AR)'s four Agriculture Training Institutes (ATIs) and DG (LSE)'s seven Livestock Training Institutes (LSTIs), which have seen progress in the use of improved agricultural advisory services. (After devolution, the capacity in some training institutes effectively collapsed, until recently. This shows the renewed commitment to this activity but it also suggests there is quite a way to go.) To demonstrate the renewed and serious commitment, a subset of the current institutes could be considered for a major upgrade to become a 'center of excellence' perhaps serving as the 'national' such center, perhaps using MANAGE in India as a model⁸.

However, the requirements for capacity building extends beyond the Directorate of Extension, and include more data compilation and analytical skills. The On-Farm Water Management (OFWM) should have employees who can assess demand for water in real time, and communicate that to farmers and other users. To effectively interact with other

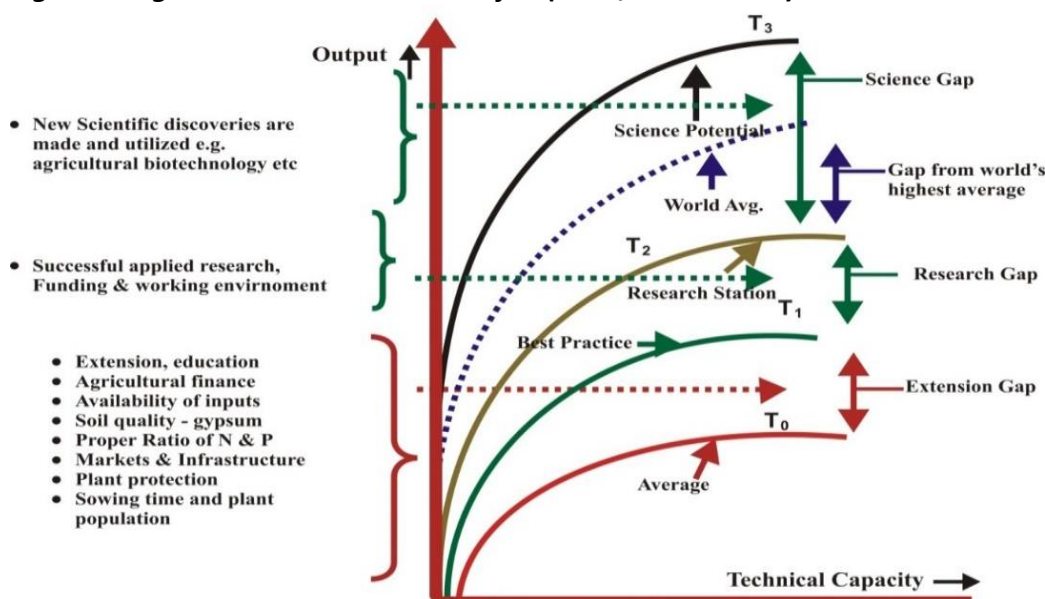
⁸ The National Institute of Agricultural Extension Management, known as MANAGE, formerly the National Centre for Management of Agricultural Extension at Hyderabad, is an autonomous [agricultural education](http://www.manage.gov.in/aboutUs/ourOrganization.asp.resrach) institute located in [Hyderabad, Telangana, India](http://www.manage.gov.in/aboutUs/ourOrganization.asp.resrach). The aim of the institute is to instill managerial and technical skills to Extension Officers, Managers, Scientists and Administrators in the agricultural economy. <http://www.manage.gov.in/aboutUs/ourOrganization.asp.resrach>

departments and ministries, PAD staff will need to have broad analytical skills to derive the implications for farmers from many different programs, policies and legislation. Building capacity in the government is only one objective, but there are opportunities along the value chain, determining interventions to help women's empowerment, and understanding climate change responses, which implies a role for government to be trainers of the population at large. With these capacity needs, a broader plan than just training for extension needs is required.

Additionally, there is a relationship between the individual training and the broader development of capacity in the various institutes and authorities. The broader institutional structures need to put in place comprehensive human resource programs to be able to shift skills among employees in the shortest time frame but in the fairest way. Where possible, incentives need to be added so that training outcomes are evaluated and can be applied. Moreover, a capable institution can evaluate its outputs and how beneficiaries are affected. To do so, organizations in PAD must hire capable staff and have analytical teams with sufficient funds to employ specialists as needed. They would need opportunities to see similar programs overseas and to connect with knowledge providers in the same area.

The Figure 2 below suggests extension, research and science gaps provide the breakdown of differences between the average production in a developing country and the maximum obtainable frontier. The frontier must progress from improved science, and with climate change, resource limitations, and growing demand for food, scientific programs must continually deliver. Therefore, a major focus in this Policy is on improving the research function by building capacity. However, recalling Figure 1, the yields of the average and progressive farmers vary by almost two times, except for maize. This suggests that an immediate and significant gain can come from more effective extension, so capacity building there is an essential priority.

Figure 2: Agriculture subsidies in Punjab (FY18, PKR million)



Source: Adopted from Evenson, Robert E. (2002) Economic Impacts of Agricultural Research and Extension. Center Reprint No. 578. Economic Growth Center, Yale University.

Linkages to other departments and stakeholders

Agriculture growth and development cannot take place in isolation, but it is a critical element of an integrated process of economic growth and transformation for the Province. Successful agriculture growth relies on the sector's linkages with the rest of the rural economy through the broader value chain and the potential for rural transformation, and through its integration with the livestock sector and agro-forestry.

The development of agriculture in Punjab is affected by other policies and strategies of the GoPunjab. The most obvious interface is with the Departments of Livestock and Dairy Development, Food, Environment, Irrigation, and Cooperatives. However, many linkages exist with Industries, Commerce and Investment, Forestry Wildlife and Fisheries, Labor and Human Resources, Women Development, Zakat and Ushr, Planning and Development and the Board of Revenue. For enhanced food security and improved nutrition, PAD needs to work with the Punjab Food Fortification Alliance and the Punjab Pure Food Authority to take up issues related to food safety and quality, and fortification. Key collaboration with the Punjab Social Protection Authority is required to devise innovative ways to reach vulnerable populations, such as the rural landless who have limited access to land or earning opportunities.

PAD can help set up and encourage a high level Interdepartmental Coordination Committee to monitor and coordinate this interface. The objectives would be to make sure that the various initiatives in different departments are consistent and efficient. Equally, if not more important, however, is the development of analytical capacity to argue about the effects of the wide array of interactions between agriculture and the other listed departments. These arguments would be most compelling if based on scientific evidence. The next sections show two areas where the ability to assess issues will be essential to the health of the agricultural sector in Punjab.

Taxes and Subsidies

Taxes and subsidies are important policy tools for governments to affect change through their control over revenues and use of expenditures. Agriculture in Punjab is subject to provincial direct taxes and fees (the agriculture income tax, land revenue, and abiana) of PKR 16.3 billion and indirect taxes (fertilizer, pesticides, electricity, domestic sales, etc.) as well. In Punjab, the agriculture income tax accounts for the smallest contribution, while Abiana (water charges) is the largest. In addition, federal tax revenues attributed to agriculture (on agricultural inputs, products and processing) in Punjab amount to approximately PKR 81.5 billion⁹.

The sector also receives annual subsidies (direct and indirect) estimated at nearly PKR 131 billion for FY18, with 41 percent being paid by the provincial government, as detailed in Table 1 below. From a provincial perspective, this seems like a positive outcome, as resources are transferred from Federal sources to the province. This is the case for the electricity subsidy on tubewells, which is the second largest Federal payment and is a direct benefit to farmers. However, the fertilizer gas subsidy goes to manufacturers of fertilizer and so gross amounts are not indicative of the actual benefit to agriculture in the Punjab.

⁹ assuming the share of the Punjab of 70 percent of total federal tax revenue

Beyond just the overall benefit to farmers from subsidies, two concerns exist. First, subsidies can have negative effects on the longer run performance of the sector. Subsidies on inputs lead to unbalanced use of fertilizer and irrigation water, and for irrigation water, the low abiana and low collection, leads to less than optimal resource use and low productivity, as well as salinity and water logging. Subsidies on tubewell electricity result in excessive use of groundwater. Water subsidies lead to similar outcomes as water is becoming scarcer, but this pressure is not recognized through prices or quantity limits.

The wheat procurement program carries the largest subsidy burden for the provincial government, estimated at nearly PKR 35 billion, and has several negative effects on the growth and performance of the agricultural sector. First, prices are above international levels, thus inducing more production than would otherwise be the case. These cause losses to the government more than the support program itself through added storage and handling costs. When sold at higher prices to consumers than the cost of imported wheat flour, the extra production thus hurts both urban and rural consumers, including some farmers, who are net wheat buyers. (Research finds that only 26 percent of wheat producers are net sellers, who are mostly larger farmers.) This program additionally ties up land, fertilizer and water resources that could go to other products. Since wheat is a major commodity, its price increase can also lead to an increase in the cost of some inputs.

Table 1: Agriculture Subsidies in Punjab (FY18, PKR million)

Item	Subsidies paid by the Federal Government in Punjab	Subsidies paid by the Government of Punjab	Total Subsidies
Fertilizer Gas Subsidy	31,500 ¹	0	31,500
Reducing General Sales Tax (GST) on DAP from Pakistan Rupees (PKR) 400 to 100/bag	9,660 ²	0	9,660
Reducing General Sales Tax (GST) on Urea from PKR400 to 100/bag	8,190 ³	0	8,190
Reduction in electricity tariff for tubewells from PKR8.85 to 5.35/kwh	22,995 ⁴	4,305	27,300
Subsidy on imported fertilizer	3,570 ⁵	0	3,570
E-voucher based subsidy for Potash fertilizer		1,995	1,995
Wheat procurement scheme		34,965	34,965
Wheat export subsidies	1,050 ⁶	0	1,050
Interest-free loans to farmers		5,985	5,985
Irrigation M&R		6,300	6,300
Cotton and wheat seed		315	315
Crop insurance through CLIS ⁷		210	210
Total	76,965	54,075	131,040

Source: Federal and Provincial Budget Speeches 2017-18, and Agriculture Department.

¹ Total gas subsidy to fertilizer manufacturers is PKR 44.6 billion while Punjab accounts for approximately 70 percent of total fertilizer use in Pakistan. ² The total subsidy is PKR 13.8 billion of which 70 percent is in Punjab. ³ The total subsidy is

PKR 11.8 billion of which 70 percent is in Punjab. ⁴ The total subsidy on electricity for tubewells is PKR 27.0 billion and 85 percent of tubewells are in Punjab. ⁵ The subsidy on imported fertilizer is budgeted at PKR 5.0 billion of which 70 percent can be assigned to Punjab. ⁶ The total subsidy is PKR 1,501.5 million of which 70 percent is Punjab. ⁶ Crop Loan Insurance Scheme.

The second concern is that the process of reallocating funds to better uses is complex because of the institutional location of each subsidy. The wheat procurement program is the Food Department, so reducing that program to shift funds to expenditures on research or extension might move those funds to PAD or the livestock department. Thus, a negotiation is required, probably managed by Planning and Development (P&D), to try to reallocate the subsidy, which is therefore likely to be complex and slow moving. Likewise, all changes in water charges originate in PID, with abiana payments, while many of the outcomes affect farmers, so that decisions are made separately and likely with insufficient coordination. In these cases, the main avenues for PAD is to develop an analytical capacity to argue on behalf of farmers and rural communities, and try to find solutions that benefit all engaged departments and external stakeholders as well.

Overall, unproductive subsidies in agriculture should be phased out, the productive ones should be better targeted and the savings in resources from these should be diverted to higher value areas. At present, many of these subsidies benefit larger farmers, so at least this should be an explicit choice if that is the purpose for such programs. Better uses for these scarce funds exist.

Agriculture Growth Exchange Rate and Trade

The growth prospects of Punjab agriculture depend partly on its ability to export. It is envisaged that this growth will come from horticulture and value-added products and from import substitution of edible oils, lentils pulses, gram, peas and beans. However, the national trade and exchange rate policies have acted as a deterrent to export prospects for agriculture due to the overvaluation of the Rupee, which leads to an anti-export bias. An overvalued exchange rate gives export competitors of Punjab's rice or cotton an advantage in price. This anti export bias is responsible in large measure for the dramatic decline in agricultural exports over the past several years.

The consequences are clearly affecting farmers, but the control of outcomes in this area is far outside PAD, but rests with various ministries in the Federal government. Nonetheless, PAD should have an ability to quickly turn around the effects of outcomes in the exchange rate on its stakeholders. The issue needs continued review to provide evidence whether losses to agriculture from an over-valued exchange rate outweigh gains from cheaper imports and lower debt repayment costs. PAD will track these changes with a dedicated group in the department, and also examine the tariff and non-tariff barriers to agricultural trade, including the trade regimes of neighboring countries, where subsidies add to the trade advantage from Pakistan's overvalued exchange rate.

Stakeholders and Beneficiaries to Mainstream into Policy Actions

Three groups of stakeholders, who are also capable of providing support in important ways, should be included as centrally as possible in all actions taken through this Policy. The Small Commercial Farmers (SCF) have the capability to take risks, adopt and adapt technology, and have the largest production and consumption multipliers for overall growth and poverty

reduction. A more empowered female labor force will raise agriculture production exponentially and affect food security and the nutrition status of children, so strengthening and formalizing the engagement of women in agriculture is critical. The so-called youth bulge is leading to many unemployed but educated rural youth, who could, with the right programs and incentives, contribute meaningfully to the development of a modern agricultural system.

Targeting the ‘Small Commercial Farmers’ for Rapid Agricultural Growth

The ‘Small Commercial Farmers’ (SCF) potential for inclusive agricultural growth – The small commercial farms, between 3-acres to 75-acres in size, comprise 58 percent of all farms (of those with any land) in Punjab, but 78 percent of operated acres and 73 percent of the value of production, along with three quarters of fertilizer use, value of labor used, and energy use. The SCF have the capability to take risks, adopt and adapt technology, and have the largest production and consumption multipliers for overall growth and poverty reduction. A specific focus towards these farmers, in addition to addressing disparities in productivity and prices across agro-climatic zones, thus has the largest potential for immediate agriculture growth and poverty reduction at the same time.

Many stakeholders may feel that the role of the government should be to protect the smallest farmers, who have the least ability to take advantage of opportunities in modern agriculture. Therefore, in this view, subsidies and programs should be directed to them. However, the farms that in fact control production, can create better yields and adopt new technologies are slightly larger than the very smallest farms, but have much better prospects. Most programs cannot really distinguish precisely between the very small farmers and those that are slightly larger, but care is needed to make sure that programs reach the SCF as well as just small farmers in general. Fertilizer subsidies maybe should be extended to somewhat larger lots, for example, and while warehouse receipts may be inaccessible to the smallest farmers, they may be very good options for the SCF. This does not indicate a lack of concern for these very small farmers, but rather suggests that they may be most effectively supported through other social protection programs.

Empowering Women for Inclusive Growth and Food Security.

Although women make up 46% of the labor force in agriculture, forestry, and fisheries in Punjab¹⁰ alone, most of their work in agriculture is unpaid and considered informal, and is thus not accounted for. Even where women are paid, their wages are about 50% less than their male counterparts¹¹. Available survey results indicate that in Punjab, like other provinces in Pakistan, women are less likely to own income-generating assets such as land, agricultural equipment, or livestock, or have a say in the household’s production and other decisions. Not only are women underprivileged overall, but female headed households, at about 5% of farm households, are found to be the most food insecure and impoverished¹². Recognizing that a more empowered female labor force could raise agriculture production exponentially and favorably impact the food security and nutrition status of children, strengthening and formalizing the engagement of women in agriculture is critical.

¹⁰ Based on data from Pakistan Labor-force Survey 2013-14

¹¹ Based on data from Household Integrated Economic Survey (HIES) 2015-16.

¹² Based on data from Household Integrated Economic Survey (HIES) 2013-14.

The challenges to raising the status and contribution of women in agriculture is immense, given the informal and unpaid nature of their situations. However, several important dimensions that can change the position of women in the households can be affected by programs developed in this Policy. Two of the most important are whether women control an income source and if they are educated. The latter is longer run, and outside the control of PAD, but role models can be developed by adding female extension agents, who can give some educational opportunities to rural women and promote their potential by engaging in awareness campaigns. PAD can take these campaigns to textile firms to have them encourage formal employment for women in cotton farming. Also, the Extension Directorate should create a combined nutrition and diversified production program for women, which have favorably impacted food security, diversity of production, and the nutritional status of children in other countries.

Engaging Educated Rural Youth as Catalysts of Change.

An alarming phenomenon in the Punjab is the large percentage of unemployed graduates and post graduates in the province, as nearly 55 percent of graduates and 40 percent of post graduates were seeking employment in 2014. This cohort of unemployed graduates, properly trained and incentivized, can act as catalysts of change, compensate for capacity constraints and connect systems to enhance inclusive agricultural growth and poverty reduction in Punjab, ultimately by finding ways to provide services that will be paid for by the farming sector and other communities. These youths, when gainfully employed, should focus on activities that promote the SCF, given the strong public-sector linkages that will likely forge their development.

Groups of these youths should be associated with extension through proposed extension agent linkages to the private sector, and they can be recipients of grants from the Agricultural Innovation Fund, (both presented below) which will have engagement of rural youth as a specific objective. To have an institutional structure, these groups will be developed at district universities under Higher Education Commission (HEC's) entrepreneurship development programs. They shall operate under university academics to give necessary skills for them and their clients, the small farmers of Punjab, to operate as small businesses. This structure will thus have the important characteristic of creating links between universities, the private sector and Punjab's Extension Directorate.

Box 1: PAD initiatives to assist farmers

Five innovative ongoing programs provide the additional formats which can be leveraged by these educated interlocutors. These are:

- Connected Agriculture Punjab Package (CAPP) - Telenor Pakistan and Tameer Bank recently joined the government of Punjab to create the CAPP, which includes a wide array of initiatives and services to farmers, such as interest free loans, subsidies and access to consultancy and advisory services regarding crops and fertilizers. These services are provided via a comprehensive digital mobile platform and 125,000 smartphones will be distributed to farmers to allow access to this platform.
- Farmers' Registration Data: Under the Kissan Package, small farmers are being registered for eligibility for loans. Farmers' data is uploaded to this data on the e-portal (e-pass book) to the PITB.
- Data from Crop Reporting Services (CRS): This wing is collecting extensive farm level data on productivity and input use (seed, water etc.). In collaboration with SUPARCO, it is now doing GIS mapping and piloting the use of drones to monitor cultivable land and manage inputs with to enhance yields. CRS now has a smart phone enabled app that enumerators use to collect field level data in around 1,200 villages across Punjab.
- Switch Solutions: A joint initiative of SWITCH SOLUTIONS 'Bakhabar kissan' aims to improve agriculture productivity via technology that provides farmers access to the latest farming techniques, cures of diseases, amount of fertilizer to be used for a specific crop and every information which is required by farmers to increase yield and profitability.
- Other Pieces of Technology—Various WhatsApp groups of the extension wing have been developed for interactions among group members, including attendance and monitoring of activities.

These rural youth groups can act as service providers to bridge knowledge gaps and as market agents to aggregate and transact larger volumes in the market for small producers. They will assist farmers in understanding and making use of information the new PAD programs. (See Box 1). They shall develop business plans and seek funding from commercial banks, for which PAD can facilitate guarantees from organizations such as the Pakistan Poverty Alleviation Fund and the National Rural Support Program. Participation shall be evaluated regularly and promoted through nationally advertised competitions to identify bankable ideas. Each selected group should identify one activity of social responsibility that it would commit to undertake to be part of the program.

MAJOR INITIATIVES TO SUPPORT MODERN AGRICULTURE IN PUNJAB

This section gives the main initiatives to be addressed under this policy. The two dominant institutions for development within the public sector are Research and Extension, and so are discussed first in this section. Then presentations of the main innovations in output and input markets to be considered are made. These look at output markets, and relatedly, the opportunity for more diversification and production of high value crops. The main input markets reviewed are for seed, water and land, with a final consideration of climate change and its effect on agricultural production.

Research, Extension and Dissemination

Informed decision making based on evidence is critical for the success of any policy. While the Government's role should essentially be one of a facilitator and regulator, technical research, and its extension and dissemination, are essentially public goods that require Government provision. This policy therefore places a major emphasis on reforming research, extension, and dissemination, and on building capacity.

Agriculture Research – A Critical Foundation

The performance of the public and private sector research system is central to the creation of a dynamic agriculture that address food security and poverty through inclusive growth. However, Punjab's public spending on agricultural research and development as a percentage of agricultural GDP is the lowest in South Asia. As such, the research produced thus far has generally been of variable quality. Moreover, agricultural research priorities are mostly supply driven, based on current staffing skills, and there is little prioritization of emerging issues, limited peer review, weak research-extension-farmer linkages, and limited monitoring and evaluation of research quality and impact. There has been little incentive for researchers to improve output, as promotions, salaries and benefits are linked to research papers published, without consideration of quality.

Earlier reviews have underlined the lack of incentives to scientists, excessive bureaucracy, the limited cooperation between universities and research institutes, inadequate linkages with international research programs, and a lack of an effective liaison with agricultural extension and development agencies as major concerns. Also, ideas on solutions have been echoed since then as well, which are to create "semi-autonomous research organizations" so that researchers can respond more quickly to new issues and can build capacity needed to keep up with current scientific practices. Consequently, Pakistan Agricultural Research Council (PARC) and National Agricultural Research Council (NARC) at the federal level, and Punjab Agricultural Research Board (PARB) at the province level, were established, followed by several rounds of reforms of PARB. Yet the latest review suggests that many of the same issues found in earlier reviews still exist.

To address these issues, the Policy presents initiatives to continue to take the PARB system forward, which looks at ways to reflect value chain perspective and becomes more receptive to demands by farmers. Since the beginning, PARB has been created not to conduct its own research, but rather to "plan, facilitate and coordinate" research of the agriculture and livestock research system. It also plays a role in capacity building in the system, by facilitating professional activities and scientists' participation. If it works correctly, PARB should be able to provide significant coordination of research work, and help identify priorities for the major efforts seen by the government and stakeholders. Currently, all research-oriented Annual Development Program (ADP) funds for competitive grants are routed through PARB, and a further restructuring and re-design is underway. These proposals must be used to direct PARB improvements, and these will.

The second major challenge is to shift from supply driven to demand driven research. This can partly be done by PARB through its allocation of funds, but the Board does not have the expertise to determine where the greatest opportunities lie, given the many crop and livestock commodities that are subjects of research. Therefore, it needs an associated technical structure to help set priorities, and monitor progress on these determine human resource and funding needs, when considering those priorities. A good starting point for the intermediate term is the commodity boards constituted in Ayub Agriculture Research Institute (AARI), which can be expanded to have a greater role in governance, priority setting, and be made more independent. Recent appointment of experienced farmers, processors and exporters from the private sector to the Commodities Research Boards is a step toward engaging stakeholders in setting the research agenda. But it is unlikely to

succeed unless the Boards are empowered to implement research priorities and monitor progress.

With improved funding, independence and mandates, PARB and the commodity boards will make real progress in setting priorities and directing funds to high priority areas. However, these effects will inevitably be limited due to the current fragmented and duplicative public research system. At present, there are 25 institutes focusing on various subjects in AARI and 141 stations. Soil and water research is done by 14 international, federal and provincial research bodies. It may be more effective to start with the development of medium scale, multiple institutions, focused projects on various topics, which should be facilitated by PARB projects in conjunction with the commodity boards, to drive research into major focus areas supported by stakeholders. It will also identify research gaps and duplications in the process of building these projects.

A second step would be to aggregate successful projects into larger programs. This would be the first step towards strengthening the disciplinary institutes/departments, and progressively making more of the research scientists' time contracted under explicit programs. These projects would also give incentives to the scientists and project managers. Quality output in a reasonable time frame would be expected. Ultimately a complete review of the system, its human resource base and cadre, incentive structure, and the overlaps and gaps is necessary. The roles of Agriculture as well as the Livestock Departments, Directorate Generals of Extension and Adaptive Research, PARB, and AARI would be reexamined and reformed to rationalize their mandate, authority, funding, as would a reframing of the PARB law accordingly and to remove duplications.

In the short term, the research system can examine short run productivity growth prospects based on 'catch-up' growth by the small commercial farmers, for which increased and balanced input use, and better use of timely information, are central. For continued growth in the medium term, the size and productivity of the agricultural research system, and its full integration with an upgraded extension system, with complementary private sector involvement, is critical.

Agriculture Extension Services

The role of agricultural extension (public and private) is to provide knowledge and technical skills to farmers. Over the past seven decades, several models have been tried in Punjab, either as standalone strategies or as part of community/village development plans. The widely used Traditional Extension Model, the Training and Visit Model, and the (current) Village-level Extension Field Schools have produced mixed results, primarily as reflected in the growth of productivity. The approaches are often top down and supply driven, and rely on individual extension agents. Instead of specializing, this agent needs to cover a very large region, with no prospect for specialization and little incentive to improve skills. This issue was exacerbated by the devolution of agents to local governments for many years. Also, there is poor coordination between extension and research, and the regional coverage of the total extension system is small – barely 20%.

Despite these past limitations, Agricultural Extension is the frontline of the Department's linkages to farmers, and requires significant and creative public investments and capacity

building. Areas for emphasis are to increase specialization and knowledge, make greater use of ICT, and increase partnerships with the private sector and civil society. Many such efforts are underway and need continued development and careful evaluation as they go forward.

While the use of ICT has been limited and emphasized a simple communication of messages in the past, the recent launching of the Connected Agricultural Platform Punjab (CAPP) has taken these applications to a higher level. Through this program, over one hundred thousand smartphones will be distributed farmers to connect them to expert advice and provide expedited access to credit. Also, the ambitious 5-year Project 'Extension Services 2.0' aims to collect soil samples from 10-acre blocks of land, or for 2.8 million samples over five years, and have them tested in Department laboratories. In addition, the program will establish helplines, and develop a variety of ICT based approaches to provide farmers with expert advice based on results from soil tests and for other issues. The AgriSMART program is an ICT based reporting and personnel management process, with an area-based structure, for many extension agents. It has the potential to be expanded by adding a monitoring layer, ensuring location validation, reporting aggregate compliance, and by adding a farmer feedback module.

The heart of an extension system is its human resources, but in addition to small numbers relative to demand for its services, most field assistants are hired at low grades without much specialized training or advanced degrees. In addition, the Directorate does not have a systematic plan for updating its human resource base. The Policy then proposes that the Directorate focus on a building a medium-term plan to replace staff with higher degrees as retirements and other openings occur, and to make a significant proportion come from outside hires. Part of this plan would provide current staff with opportunities to obtain advanced degrees. Additionally, the system is woefully short of female extension agents, so redressing this issue should be a priority. These new female agents can make the Women's Open Schools more effective and widespread, and can create programs in nutrition sensitive agriculture. Even with a more knowledgeable staff, greater resources for transport, program development, and training will be needed.

In the end, this human resource plan should lead to a smaller staff, but with greater specialization and more education, and have agents with the capacity to make better use of ICT approaches and benefit from training programs. Additionally, a current challenge is the lack of promotion opportunities in the system, where only a few people can reach higher positions. This needs to be recognized and options must be created. One such possibility is to permit private sector activity by extension agents, provided sufficient oversight and incentives can be designed.

It is unlikely that the capacity in the public extension system can ever handle the full range of "on-the-ground" interactions needed with farmers, so systematic development of linkages with civil society and the private sector is critical. While done informally in many instances, the productive use of both groups can be managed more completely if incentives are added to performance contacts and Agri-SMART programs. The role of civil society and the private sector thus need to be carefully reviewed and built into the longer run programs in Punjab's extension.

The private sector can take on significant roles in numerous areas. These might include advice on and delivery of fertilizer and pesticides, mechanization, irrigation and water management services, and a variety of other information advisory services. The role of public extension would then shift towards one of quality control in these areas. The private sector could be more engaged if extension agents actively take a role in those activities that are sanctioned by the Department. If agents can develop certain approved private sector programs and relationships, whether they be firms, or information, or training products, the reach of extension can be increased, new funds obtained, and opportunities for direct growth of the private sector enhanced. Partnerships with universities to make use of incubators, and use of the Agricultural Innovation Fund can help extend this possibility.

IMPROVEMENT IN AGRICULTURE INPUT AND OUTPUT MARKETS

Agriculture Output Markets

Agricultural output markets that function well can contribute significantly to the development of an agricultural sector: they aggregate output from small holders; foster price discovery across time and space; and insure quality standards. If these functions are competitively done, adequate returns to storage should result, the availability of food across time would improve, and the incentives to invest should become apparent. With storage and adequate price signals, programs to enhance opportunities for farmers can be created, including contract farming, warehouse receipts that add credit options and an expanded choice on when to sell. This should ultimately create better opportunities for value added investments in agricultural processing, horticulture and livestock products.

The Government's historic strategy has been built around agricultural produce markets (APMs), which were originally notified under the 1939 West Pakistan Agriculture Produce Markets Act (re-enacted as in the Punjab Agricultural Produce Markets Ordinance, 1978). This approach led to insufficient expansion in central markets, as the total number of APMs increased from 169 in 1962 to 233 in 2016, a growth of 64 percent, while the total volume of commodities increased several hundred percent. Consequently, ever more agricultural produce needs to pass through a limited market infrastructure, which is also deteriorating. An associated issue has been that the jurisdiction of the APM extends to an entire notified area, rather than just being an optional market outlet, so all wholesale marketing in a region is subject to official control, and growers are required to use APMs or to sell to licensed buyers. The practice of running APMs by Market Committees through provincially appointed (political or official) administrators has raised issues about incentives of the administrators and use of funds.

Three initiatives will be pursued in PAD to modernize output markets in keeping with the goals in the Department's Vision. Of primary importance is the new regulatory framework for agriculture product marketing, the Draft Punjab Agricultural Marketing Regulatory Authority (PAMRA) Act, 2017. The intention is shift the central markets to a modern, private sector and profit-oriented infrastructure by moving away from the 1978 Ordinance to the PAMRA Act. The PAMRA Act stipulates a two-year transition period to prepare the market committees to operate in a private sector environment, and to build appropriate institutional structures. With 135 market committees in the province, this is a massive job, but, as outlined in the World Bank's Strengthening Markets for Agriculture and Rural Transformation (SMART) program, it will be completed by 2021. With success, this will raise

private investment in processing, rationalize price discovery, and tie markets across the province together.

Given the magnitude of this change, the government will provide several important roles. First, it will design systems that permit daily price and quantity reports to be more accurate and better reflect grades and standards, thereby reinforcing improvements in price discovery. Secondly, it will determine a process by which traditional assemblers and wholesalers (artis and Pharias) can be best used. These entities now connect farmers and markets and provide credit, so their roles need to evolve and they either need to be replaced effectively or are given a way to adapt, which can involve a deliberate transitional scheme. Thirdly, procedures that connect markets more clearly are also needed. These steps will use the ICT based reforms being developed to address informational inadequacies.

Second, creating a warehouse receipt system will be important to extend credit options and rationalize prices over time, as well as to make commodities more easily available over the year. This should be done by the private sector, likely in combination with public or development institutions, NGO-sponsored farmer groups, or a government mandated program. Pilots of these programs are under development in the Punjab now, especially the public private storage program with World Food Program (WFP), PAD and United States Agency for International Development (USAID) funding. A more systematic and expansive program will be designed and implemented, using India's experience with its Warehousing (Development and Regulation) Act of 2007, which established an independent regulatory authority and led to a major growth in use of warehouse receipts. The steps would be to establish the regulatory authority, create a collateral management company, and make sure that the PAMRA transition creates adequate price discovery mechanisms. The latter steps should be done under this Policy, and are in the domain of PAD, but linkages to both the provincial Food and Finance departments and the banking system must be made to complete the program.

Thirdly, a Food Outlook program will be developed to further enhance information and analysis provided to farmers. The program will be developed with academic and international partners to provide a timely forecast of prices, international trade and likely surpluses or shortages in key domestic commodities. The program will use data already collected by the Crop Reporting Service and the Agricultural Marketing Information Service, engage key stakeholders and researchers, and make use of information programs being added in PAD, including CAPP, ICT based extension products and the Department's information directorate.

Promotion of Crop Diversification and Horticulture

A rapidly growing and urbanizing population requires diversified and high quality, nutritious foods. From a supply perspective, increased diversification towards horticulture including vegetables, fruit and condiments, means greater incomes for farmers and higher growth of the sector, all of which are underdeveloped in Punjab. Vegetable production witnessed only a marginal increment of 1.3% since 1986,¹³ and the horticulture subsector contributes only 5% to national agricultural GDP, with only 7% of production being processed. Growth and

¹³ Calculations based on data from Agriculture Statistics of Pakistan (various editions)

profitability in the subsector are hampered by multiple factors, including low average yields compared to neighboring countries, high wastage rates after harvest, inefficiencies in produce markets, poor supply chain processes, and inadequate cold transport and storage infrastructure.

Yields across the country in the horticulture sector can be increased by up to 40%¹⁴, indicating a vast untapped potential for development. The opportunities for crop diversification lie in the improvement of productivity of horticulture crops, but also within existing cereal crops to release acreage and other inputs for diversification. Furthermore, promotion of pulses and oilseeds, when efficient, as import substitutes will help to improve diversification. Expanding research facilities for hybrid varieties of vegetables, oil seeds, food-grains and fodder crops will help farmers to shift to high-value crops.

A multipronged approach is needed to foster growth in horticulture. First, research needs to be improved, as just 11% of research scientists are in horticulture (and another 7% in oilseeds and pulses), but there are important new skills that farmers need to learn as well, so that focused upgrading of extension staff is also needed. Furthermore, horticulture cannot improve without a more competitive private sector that can reduce post-harvest losses, which must be supported by strengthened research capacity in food science. Additionally, there are hindrances created by current policy structures, especially rewarding water intensive crops like sugarcane, tying up excess land in wheat, as well as using relatively scarce labor in these subsidized crops, thereby raising prices and limiting availability of important inputs.

To address these wide-ranging needs, a Punjab Horticulture R&D Corporation (PHRDC) to promote horticultural development in Punjab is proposed¹⁵. Ideally, like the PARB, it would be a public entity with an internationally-recruited Chief Executive Officer (CEO), have a small high-quality core staff to do some research but also commission research from external organizations. It would be multidisciplinary with about half the scientists in business development (value chains), economics, ICTs, social mobilization, post-harvest management, and nutrition. It would further emphasize commercialization and connections with international partners such as the World Vegetable Center. The objective should be to bring expenditure on horticultural Research and Development (R&D) to 1% of the value of sector output, with about half provided by the private sector.

There are many avenues the PHRDC could take. While the demand for horticulture products has been growing steadily with rising incomes and greater urbanization, knowledge of the benefits of vegetable and fruit consumption is not widespread, so awareness campaigns to this effect should be made. Lower prices through increased productivity should also be an objective, where the most likely opportunities are to reduce post-harvest losses. When mothers and other females in farming households understand

¹⁴ See Bajwa, B. E., 2011. Prospects of value addition in horticulture crops. Punjab Agri-Marketing Company, Government of the Punjab. PowerPoint presentation. PowerPoint (ppt).19p.

¹⁵ See Ali, M., et. al. 2018. "Diagnostic Assessment of the Punjab Agricultural and Livestock Innovation System: Achievements, Constraints, and Ways Forward." World Bank, Unpublished manuscript. Islamabad.

the need for nutritional diversity, greater production of horticulture products, along with added livestock production, can be an outcome. The PHRDC can review investment options, regulatory needs and make assessments of opportunities. Contractual linkages with private sector food chains and the public-sector food department and outlets such as utility stores and Army Canteen Stores Department (CSD) could be tested as well.

In addition, to get maximum benefits from CPEC, the Punjab government should assess and negotiate tariff and non-tariff measures and pursue business opportunities including branding and marketing with Chinese and Central Asian firms that ensure inclusive, unskilled, labor-intensive growth in Punjab's agriculture. (See Box 2). The development of domestic commerce and a pro-Punjab investment policy will be essential to maximize gains from CPEC. This can best be managed by the proposed Agriculture Innovation Fund and associated programs, which are presented below. A joint China-Pakistan team acting as an Advisory and Mediation Council should evaluate linkages of CPEC to smaller, poorer and more remote sectors and regions of the Punjab to ensure that adequate benefits flow to them.

Box 2: Role of CPEC in Strengthening Punjab' Agriculture

CPEC offers great potential to facilitate increased value-addition in Punjab's agriculture and horticulture in line with the Department's needs and its goals of enhanced productivity, farmer centric service delivery and private-sector led growth. The CPEC Long Term Program envisages:

- strengthening and upgrading agricultural infrastructure along the CPEC routes;
- construction of water resources infrastructure and water-saving agricultural demonstration zones;
- increasing development and reclamation of medium and low yielding land;
- technical exchange and cooperation in areas such as seed reproduction, livestock and poultry breeding, and production technology, agricultural product processing, animal and plant epidemic prevention and control, mechanization, demonstration and ICT-enabled agriculture;
- improving post-harvest handling, storage and transportation of agricultural products; and, innovating in marketing and sales models;
- improving flood management rangeland and desert development and strengthening remote sensing technologies;
- strengthening the production of agricultural inputs particularly pesticides, fertilizers, machinery and support services, including agriculture education and research;
- collaborating in horticulture, fisheries and livestock medicines and vaccines;

Seed Sector Reforms

One of the critical drivers of productivity growth in agriculture is the availability and competitive pricing of quality seed. At present, the industry consists of three types of firms, those in the private and public sectors with extensive experience in research and development of new varieties, and those in the private sector that are small, generally informal and not registered, and have a range of capacities, and which tend to be involved in multiplication and distribution of seed, but cannot develop varieties like major companies. (Some private firms operate in both the formal and informal markets). The first group in Punjab includes multinational companies, a selected group of local firms, public research organizations, and several universities.

In addition to this diversity of firms, there is a complex set of regulations and regulatory authorities. At the Federal level, supported by the 2015 Amendment to the 1976 Seed Law,

is the Federal Seed Certification and Registration Department (FSC&RD), which controls varietal testing, registration and certification throughout the country. One of the key concerns is that, at the provincial level, the Seed Council certifies seed varieties (following recommendations from FSC&RD) with AARI and the Punjab Seed Corporation as part of the review panel. As AARI and Punjab Seed Corporation (PSC) produce seed for certification, this is clearly a conflict of interest. Also, the varietal testing system is unable to enforce intellectual property rights, in part due to a slow and taxing registration process, as well as leakages of breeder's seed during the testing process. Many of current private sector firms likely cannot protect the quality of seed that they multiply and distribute, as is thought to be a major issue with *Bacillus Thuringiensis* Cotton (BT Cotton) seed.

In developed economies, the obligation to maintain seed quality has been shifted to a truth in labeling regime, where companies develop and test varieties and self-report their characteristics. The claims are checked by a regulatory body and fines and other sanctions can be imposed for false claims. This arrangement is most effective when companies have reason to protect their reputations, so that excessive use of legal processes is not required. This is not the case for many companies in the Punjab. Nationally, the control rests primarily with FSC&RD, who use extensive variety trials and production in its certification process.

This policy proposes a new institution, the Punjab Seed Registration and Regulation Authority, in consultation with Federal and other provincial governments for consistency of approaches. The Authority will be comprehensive in its ability to permit companies to pursue "enlistment", and be subject to a truth in labeling regime, or alternatively, stay as an entity that will use the public sector to certify its varieties with strong and effective penal and enforcement mechanism. The Authority will develop benchmarks to determine whether a firm is eligible to be a variety developer at all, basically that they have facilities and the capacity to do development of new varieties, and whether they can maintain and protect intellectual property and seed characteristics sufficiently during ongoing multiplication and sales of its branded seed. The enlisted firms are likely to be a small group at first, and could be both private and public-sector. The long run goal will be to support the development of a seed industry that is mainly private sector driven, and internationally competitive, but with an effective public sector that can deliver products not profitable for the private sector, because, for instance, they are open-pollinated or lead to lower cost alternatives.

The Authority will recognize that the current structure of the seed industry has not evolved to one that can be fully run by Truth in Labeling but that would be a main target and will be supported by a transition plan. The Authority will additionally focus on providing support services, such as accreditation, building databases, publishing directories (e.g. of seed companies and of dealers), encouraging private entities to carry out certification services, and training key agents in the seed business. Finally, care must be taken in the design of the Authority to reflect the significant investment in certification by the Federal government, the existence of the 2015 Seed Amendment and 2016 Plant Breeder's Rights Act, both at the Federal levels, and the need for consistent policies across all provinces, coordination with international markets, and the benefits to farmers of the different approaches.

Catalyzing Private Investment

Available evidence confirms that domestic commerce in Punjab is inadequate to meet the demands of a rapidly modernizing rural economy and to act as a catalyst for agriculture growth and diversification. While comprising wholesale, processing, retail, storage and transportation functions as related to agriculture, the sector is typically characterized by small enterprises and a lack of collateral, standards, quality and high moral hazard¹⁶. With poor enforcement of contracts and low levels of education, the businesses in the commerce sectors often cannot assess market information and grow along modern lines.

Although the development of domestic commerce is perhaps outside the main responsibilities of the Agriculture Department, it is critical for sustainable growth and a profitable agriculture sector, and it is clearly central to the Vision of the Department, which emphasizes “*(T)ransforming agriculture sector into a diversified, sustainable, modern and market-driven sector,*” and which can only be done with strong agribusiness growth. Therefore, catalyzing the agribusiness sector through initiatives in the Department can speed up the growth of a modern agribusiness sector, and provide better outcomes for the farm sector, women and young rural inhabitants in the province.

This policy provides the framework to establish an Agribusiness and Innovation Fund. The main goal of the Fund will be to provide incentives to agribusinesses for investments in value addition through a matching grant program, with training and capacity building programs included. The steps to be undertaken will be to notify the governance structure of the Fund, create and notify an operational manual, which would include the *modus operandi* of the matching grant component, and then to begin Fund activities. The Fund will be used to award matching grants on a competitive basis, with due consideration on the effects on women and young people, including the unemployed educated rural youth, who are noted below.

The investments might range across agricultural input manufacturing, retail and wholesale distribution, imports of hybrid seeds and even research, advisory and extension services. Services offered by the private sector under the CAPP umbrella can be encouraged as well, such as weather forecasting, advisory and crop calendars, agriculture guides, TV programs, financial services, marketing apps, and supply chain development, such as the Commodity Purchase Platform. Other uses of the funds could be to develop incubators at universities, with private sector participation, and to encourage needed changes in regulation in concert with the Departments of Industries and Commerce. In addition, the advisory committee for the Fund can commission evaluations of policies to determine effects on provincial private investment. The Fund activities should also complement the approaches taken by the Punjab Board of Investment and Trade (PBIT), which is currently taking a strong sectoral focus in food manufacturing, including promotion of fruit, vegetables, dairy, and edible oil. The PBIT special initiatives such as the facilitation of women entrepreneurs will be very helpful complements to Fund efforts as well.

¹⁶See Malik, S. 2008. "Rethinking Development Strategy: The Importance of the Rural Non-Farm Economy in Growth and Poverty Reduction in Pakistan." *The Lahore Journal of Economics* 13

Land resource management for Agriculture Growth and Food Security in Pakistan

The challenges pertaining to agricultural land use include a lack of knowledge about the suitability of land to support various agricultural activities; declining farm size and fragmentation of holdings; and a poor contracting environment due to decreasing farm size, poor performance of cooperatives and an under developed processing sector. The declining availability of surface water, increasing water logged and saline areas, poor land management practices, high population growth, and rapid urbanization have resulted in depleting overall soil quality. Nearly 1.84 million hectares of agricultural land in Punjab is degraded by salinity, erosion and soil nutrient deficiency.

Land use is of interest to numerous departments: agriculture, housing, industries, commerce and investment, forestry, fisheries and wildlife, environmental protection, irrigation and power, communication and transport, local governments and community development, tourism and finance. While land is clearly a major input to the agricultural sector, most decisions are made in other departments. Land use policy for agricultural lands rests with Board of Revenue and for urban land use, the Town Planning or Development Authorities. Land Reclamation is assigned to Punjab Irrigation Department (PID), and land consolidation efforts are under the Punjab Board of Revenue's functions. PAD will however facilitate the creation of a broader coordinating committee to ensure as much consistency across departments as possible.

While the broader government can provide support for monitoring, assessing data and preparation of land utilization maps, the Agricultural Departments will develop the analytical structure to provide evidence on behalf of farmers about the effects of different land use decisions across the economy. It can also help promote land consolidation by evaluating different market and financial incentives, evaluate the effects of rising costs and urbanization on agricultural production, among other assessments. The Extension 2.0 program will put PAD in a unique position to assess trends and effects on agriculture.

Water Resource Management

Punjab has a total irrigated area of more than 34 million acres. Within this area, farmers use canal water and subsurface water, while in semi-arid areas, rainwater is also harvested and used for irrigation, either through gravity flow or by pumps. Lifting water from seasonal *nullahs* and dug wells offer other sources of irrigation. Analyses of Punjab's water budget highlight the heavy losses at each stage of water distribution. These water resources challenges are even greater in the face of shrinking farm size and climate change. In the future, further reduction in available river water is anticipated from sedimentation of major dams and reduced ground water availability, which now accounts for about half of the water used for irrigation. Moreover, a general perception exists of inequities in the distribution between main, secondary and tertiary canals and across head and tail farmers in watercourses. Furthermore, reducing these losses in the distribution system can only be done with partnerships between different departments, particularly between irrigation and PAD.

The Directorate General Agriculture (Water Management) is the main administrative unit in PAD that deals with the intersection of water and agriculture. Over time, the Directorate has introduced many technologies for on-farm water conservation and to use water efficiently,

and is the frontline Wing that must promote ways for farmers to address effects of climate change, shrinking capacity of dams, reduced farm size, and unregulated groundwater pumping. Many of these areas are handled by Federal ministries or other Provincial departments, and so the OFWM wing needs to build capacity to make arguments about benefits and costs to farmers of various trends or inappropriate action in these areas.

So far, its programs have been based on provision of subsidized technologies and its coverage has been limited by capacity and funds. The areas of most potential are those that enhance water productivity by increasing delivery efficiency and water conservation at the farm level. The OFWM should spearhead a policy approach emphasizing 'yield optimization per unit of water.' Only such a paradigm shift can help Punjab's agriculture survive with water scarcity. Additionally, the OFWM needs to develop into the main entity that evaluates and argues for equity in the system and value to farmers through continued research and awareness programs.

Much of this would be focused on data collection, where the OFWM Directorate can initiate regular data collection on water availability, needs of various crops, extent of land levelling, and geo-referenced maps to inform its planning and implementation, with a focus on identifying the demand for water and where important and valuable needs are unmet. Promotion of new technologies will be done by OFWM as well, after sufficient evaluations on usefulness and benefit-cost evaluations. These will include improved water harvesting technologies, crop specific water saving irrigation practices, and improved farm design with High Efficiency Irrigation System (HEIS) and more extensive use of laser land levelers, and lined watercourses to be used with tube wells.

The above activities are mainly to be done through awareness campaigns, focused extension programs and information provision and analysis. Policy dimensions are equally important. The Wing can work on ways to discouraged cultivation of water intensive crops such as sugarcane and rice (by returning to a crop zoning system) and examine the value of legislation to prohibit new tubewells in rainfed areas of Punjab to help alleviate soil salinity. The Directorate can only deliver on the above mandate if it undertakes significant capacity development by adding skills in attitudinal change, community mobilization, and dissemination of information at a large scale.

The Challenge of Climate Change

The relationship between agriculture and climate change is twofold: climate change affects agricultural productivity, and agricultural production generates Green House Gas (GHG) emissions that affect climate change. With rising GHG, it is well known that temperatures rise, and melting glaciers and higher river flows result for a time. In addition, the timing of summer monsoons and increased rainfall are other consequences. To manage these changes in water availability, both seasonally and across time, better flood control works and disaster preparedness is needed. These trends, particularly greater surface water flows, also create opportunities but will require significant investment to conserve soil and water by flood diversion and water harvesting and storage.

Adaptation to higher temperatures and varying availability of water resources will require different crop varieties and livestock breeds, as well as improved on-farm water management practices to conserve soils and moisture. The Policy focuses on priorities for

adaptation to increase Punjab agriculture's productivity, while protecting farmers against the detrimental impacts of climate change. With effects of up to PKR 1.05 trillion in lost income from a 5 percent annual decrease in agricultural productivity due to climate change, significant benefits can come from investing in adaptation strategies, and sizable expenditures are justified.

Pakistan's total GHG emissions in 2015 were 405 million tons of carbon dioxide equivalent, an increase of 87 percent since 1987 (USAID 2012; Ministry of Climate Change 2016). Most of these emissions came from the industrial and agricultural sectors, with agriculture contributing 43 percent of total GHG emissions. The majority of GHG emissions in agriculture are from enteric fermentation in livestock, chemical fertilizers and manure, paddy rice cultivation, and soil disturbance through tillage. As a signatory to the Paris Climate Accord, Pakistan is pledged to reduce 20 percent of its projected emissions by 2030, and a significant share of Pakistan's pledged reduction may have to come from Punjab's agriculture sector.

Mitigating effects of agriculture on climate change by reducing GHG emissions can come from helping farmers adopt sustainable and climate-friendly practices and techniques, or Climate Smart Agriculture (CSA), without sacrificing productivity, as the Accord states that steps to reduce emissions should not compromise productivity. While many recommended steps lie within a Livestock Policy, a number relate to agricultural practices, including the provision of high-quality feed, the capture, transport, and storage of manure, appropriate application of manure, fertilizers, and nitrogen-inhibitors, and conversion of manure to biogas using anaerobic digesters.

The main thrust of the Policy around climate change will be to establish an Institute for Climate Smart Agriculture (ICSA) to coordinate ongoing activities in the Department. The ICSA would be tasked with evaluating, finding resources for, and promoting beneficial CSA technologies (those that increase food security and simultaneously promote mitigation or adaptation). These range across water management, including laser land leveling and alternate wetting and drying of rice, improved crop and livestock varieties, integrated pest and manure management, and renewable energy technologies, among others. There are hundreds of areas to promote under CSA, so the ICSA must have significant capacity to stay on top of changing opportunities, and determine which areas should be pursued most vigorously. As CSA programs requires more than one Wing or Department, a primary function of the ICSA would be to coordinate across government agencies, as well as with the public and private sector institutions, and to keep issues of climate change visible to stakeholders and government departments.

MONITORING AND EVALUATION AS THE BASIS FOR POLICY REFORM

The overall effectiveness and success of this Policy depends upon science based planning and implementation within an effective results-based monitoring and evaluation system. Specifically, it requires setting up baseline data and monitoring well-defined benchmarks. The system should generate timely and accurate data and evaluations about (1) whether correct programs are being pursued (those that can have impacts), and (2) whether they are being implemented appropriately (they are headed towards desired outcomes and impacts). While the policy presents priority programs that are expected to have impacts, it is

important to learn from experience and to review and revise all efforts for maximum effectiveness. The first point measures relevance. The second one relates more to accountability i.e. having decided to on a policy, program and or initiative, it looks to efficacy and efficiency.

The current Monitoring and Evaluation (M&E) system collects a large volume of data, which are rarely used for decision making, as they are generally not available in a useful and useable form. There is no central repository or data warehouse, and the bulk of current M&E data lacks baseline information, which makes later impact evaluations impossible. Recent improvements have been made with the introduction of performance contracts (PCs) for DGs across the Agricultural Department to track directorate performance and make them accountable. Key performance indicators (KPIs) are in place to track quarterly performance, which have been identified for service delivery, development projects and special initiatives. The Quarterly Performance Reviews (QPRs) set parameters for timelines, horizontal and vertical reviews, and give roles to the quarterly review teams and data collection, which are important steps forward.

To develop an effective ICT based monitoring and evaluation system, all existing platforms must be consolidated. Specialized staff at the Head Quarter (HQ), Division and District levels are needed to develop an ICT-based data collection protocol and data warehouse. Within the warehouse, data will be processed to make it available in an easily accessible form for key decision makers and managers.

The M&E system should also define baselines for PAD in general and for individual projects, including the streamlining of information on ADP projects to the P&D for reports on progress of projects that will remove hurdles to the release of funds and approvals. This will also facilitate the assessment of progress over time and enable evaluations to permit evidence based corrections. The overall system should essentially generate monitoring information that can be used at three levels of evaluation: outputs; outcomes; and impact.

This integrated M&E system will be taken forward by the development of an M&E policy, which will define linkages of individual performance to outcomes and impacts. Future promotions and capacity building activities would be linked to the performance evaluations of individuals. This policy also will provide clear guidelines to the workforce about what is expected of them and what constitutes output, outcomes and impact. To make this system successful, the department is committed to provide ample human and technological resources which can make this system work in an efficient manner.

CONCLUSIONS: KEY INSTITUTIONAL INNOVATIONS AND MANAGING REFORMS

Change management starts with a structured approach to moving departments and individuals from a current state to a more desired state, basically by institutional development to revise and promote new mandates, increased capacity and reallocation of finances to better uses. The department has a thorough understanding of the challenges and constraints facing agriculture in the province, and has designed numerous innovative programs, institutional structures, regulations and investments to transform agriculture into a sustainable and modern market driven sector. Some of these include ICT empowerment, efficient resource utilization and revamping existing practices and rules. However, it is one

thing to design improvements and another to implement them, which demands a deliberate and ongoing approach to Change Management. Here, we point out some of the fundamental institutional priorities and then some comments on essentials of change management .

Institutional development priorities

This policy sets forth an ambitious agenda to take forward the agricultural sector to a private sector driven and profitable sector, while at the same time accounting for major social and environmental issues. The key is to revamp efforts made in PAD to along new institutional structures, and then add technical and financial resources to make sure they are successful.

Major New authorities and institutes

Five major institutional structures are proposed in this Policy. They are each designed to increase coordination, raise visibility of the issues and add technical and financial capacity in the relevant area. They are:

1. Establishment of Punjab Seed Certification and Registration Authority to ensure healthy and safe seed, improve productivity and regularize the seed sector. This Authority will carefully review the capacities in the public and private sectors, and provide and implement a transition to a system built on Truth in Labelling approaches in the future.
2. Establish an Institute for Climate Smart Agriculture (ICSA), to coordinate, oversee and advise on all climate sensitive decisions within the Agriculture department and liaise with other provincial departments e.g. Livestock, irrigation, EPA etc.
3. Establishment of Agricultural Marketing Regulatory Authority (PAMRA) to bring innovation into the old agricultural marking system by making it more competitive and transparent. This Authority will guide the transition of the old government controlled markets to a modern private sector, profitable system.
4. Establish a Punjab Horticulture Research and Development Institute (PHRDI) to increase the acreage of High value crops and direct research into the
5. Establish an Agribusiness and Innovation Fund along with its governance structure to provide incentives for private sector investment in agriculture, agribusiness, value addition and technology. It will encourage the participation of women and rural youth.
6. Establishment of a Directorate of Human Resource Development for capacity building of in-service officers and farmers.

Two of these developments, the PAMRA and the Agricultural Innovation Fund can be initiated quickly, as the legislation for PAMRA is in process and the Fund can be made ready within the short term as well. For the others, design and stakeholders' involvement can begin immediately, but the full implementation will still take time.

Updating and changing missions, and raising capacity in current Directorates.

Some of the important areas where improved capacity will be needed are listed below.

1. Centralized ICT based M&E and evidence based decision making for all wings, directorates and institutes.
2. Raise the analytical capacity in PAD and link with external specialists. Some of these skills include assessing the demand for water in real time, tracking the prevalence of

subsidies and their consequences, arguing forcefully about exchange rate policies and effects on farmers, and developing a regular food outlook program.

3. Establishment of a Center for Excellence in Extension to implement an integrated extension and adaptive research strategy and upgrade the extension knowledge base.
4. Institutionalizing warehouse receipt system throughout the province, making it the primary source of micro credit for the small famers and getting the right price for their produce.
5. Re designing and funding PARB to provide broader coordination of Punjab's research, and shifting the public sector's research to be more demand driven and reach beyond the production sciences.

To change an organization, the organizational culture, its values and its directions need to adapt to accomplish set goals¹⁷. Change is difficult because every segment has concerns. A first and major concern is job security, which makes staff fearful. Additionally, concerns exist if staff feels they cannot do the job effectively in a new system. Finally, some stakeholders, including staff, may feel that the directions are wrong. To address these legitimate concerns, the department must be very transparent about the changes envisioned and communicated. It also requires a consultative approach when taking major decisions. Change cannot come unless the senior management endorses it, supports it, puts it front and center and take it to its logical end. The department should also put in place a robust performance management system and back it up with accountability. At the heart of all change needs to be a human resource plan that identifies the desired changes in capacities and roles that go allowing with the new missions. These are elaborated in the next section.

Making Reforms Successful: The role of Change Management

The process of change management will be achieved through several strategies. PAD has taken steps to put programs in motion that help move it to a more progressive institution, while senior management has created many important targets, and is aware of the way forward. They are actively supporting reforms by providing human, financial and technological support. This commitment will need to remain evident over time, with changes in Secretaries and Additional Secretaries.

The success of this large-scale agenda depends crucially on how the change is nurtured and managed, both to ensure sustainability and to make use of external factors, such as adoption of technology and structural advancements. Adoption of ICT-based interventions will be the centerpiece of envisaged process, from top to bottom e.g. incorporating monitoring, evaluation and learning mechanisms on IT platforms/systems, evidence-based decision making and centralized data warehousing, etc. Staff will need to understand these requirements, receive adequate training, and to learn that these tools can make them more effective and successful in their jobs. Therefore, it is imperative that these tools be presented as being supportive rather than controlling, and their potential be well outlined.

¹⁷ See Blanchard, Kenneth H., et al. Who Killed Change?: Solving the Mystery of Leading People through Change. William Morrow/HarperCollins, 2009.

The re-design of human resources within PAD is probably the most fundamental change required, and it must consider skills gaps and possible changes in the demand for services. This is a complex process, which will need analysis, creation of a full system of on-the-job training mechanisms and have a system of performance contracts and evaluations built in to monitor change. At the one extreme, there is the very large number of field assistants in the Directorate of Extension, where designing a human resources program, with appropriate training options and a hiring program, is a long run effort, but the first steps need to be made. On the other hand, the new institutions, such as the Institute for Climate Smart Agriculture, the Punjab Seed Certification Authority, PAMRA and others will need dynamic leadership and resources soon to be effective. A strengthened second tier management would play a key role in realizing the true potential of these institutions, and so that program should start sooner. Fortunately, it will include a much smaller group.

Communication is an important part of the change process; and ties together the various efforts. The ICT initiatives will operationalize this by providing different tiers with information that will help them in decision making and course correction. The department will take everyone along in this process, small, medium and large farmers, private sector, international donors and academia, again with a significant part led by the ICT approach. The changes expected under this policy requires direct as well as quality communication between farmers, department officials and particularly extension staff, market functionaries, researchers and academia as well as the entire range of stakeholders that impact on the decisions to modernize agriculture. There will be of course be some who resist the change process. The strategy here would be to resolve impediments first. If the problem persists, after communication, training and a clear human resource plan developed, attempts should be made to shift those involved to other activities but in the end some people will leave. A robust annual performance process will make sure this group is stays at a minimum, and recognition of talented and hardworking individuals is continually done, with the process being considered fair.

Policy Matrix for Punjab Agriculture

Policy Area	Brief Description	Proposed Actions	ST/ MT/ LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
Agricultural Extension	Agricultural Extension, a key linkage with farmers, needs to be equipped with current knowledge, specialization, use of ICT, and effective partnerships with private sector and civil society to promote high value and climate resilient agriculture	<ul style="list-style-type: none"> • Reorganize and strengthen extension system to disseminate innovative and updated information to the farmers • Introduce ICT for effective information dissemination and monitoring • Build Partnerships 	<p>ST-MT</p> <p>ST-MT</p>	PAD DG Ext. DG Research PM&E	<ul style="list-style-type: none"> • Identify existing gaps and ICT capability in extension system and develop 3 years plan for improvement • Establish a platform for collaboration and coordination with Commodity Boards, Universities and Research to sharpen extension • Establish M&E System in PAD/Extension Wing • Expand AgriSMART to be a full M&E system with: <ul style="list-style-type: none"> ○ Monitoring layer ○ Location validation ○ Aggregate compliance ○ Farmer feedback • Build interfaces with 	<ul style="list-style-type: none"> • Upgrade at least one training school as Centre of Excellence in Extension • Redesign & modernize curricula in Agriculture Training Schools/ Institutes to meet the current and future demands of the sector • Organize refresher training courses for extension staff • Equip the staff in use of ICT • Incentives to improve academic qualification • Impart knowledge in area specific value chains (Citrus in Sargodha, Mangoes in South Punjab, and horticulture) • Training in Sanitary & Phytosanitary (SPS) 	<ul style="list-style-type: none"> • Outcome based improved extension service delivery • Transition towards public-private partnerships • Adoption of modern agriculture practices for higher yield and water productivity • Shift to HVA and CSA • Improved value chains of select commodities

¹⁸ Give acronyms of the Wings/Directorates etc to use in this column

Policy Area	Brief Description	Proposed Actions	ST/ MT/ LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
		<p>with private sector for use of modern technologies and inputs</p> <ul style="list-style-type: none"> • Establish Institute of Horticulture • Complete Extension 2.0 • Develop and implement Human Resource improvement Plan 	<p>ST-MT</p> <p>MT-LT</p> <p>MT-LT</p> <p>MT-LT</p>		<p>CAPP, What's App and other ICT platforms</p> <ul style="list-style-type: none"> • Add check off reviews for messages in CAPP, What's App and other ICT products of Extension • Design operational MOU for building partnerships with private sector and establish platform for coordination and regular feedback/monitoring • Convert one of the existing research institute or prepare/approve new scheme • Allocate funds • Complete 2.8 million samples • Soil Testing surveys results be shared with extension staff and farmers for better planning 	<p>requirements and nutrition sensitive agriculture</p>	

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
					<ul style="list-style-type: none"> • Establish helpline • Review existing system of recruitment, qualification, compensation package, and training and restructure the cadre, incentives package and training in coordination with Finance Department • Increase female extension staff & rural youth • Improve mobility 		
Agricultural Research	Research is central to the creation of a dynamic agriculture. Punjab's public spending on agricultural research is low and its research has been of variable quality.	<ul style="list-style-type: none"> • Restructure and redesign the mandate and management of PARB and its funding for better prioritization and coordination of agriculture research work in Punjab to reduce fragmentation and duplication in public sector research 	MT-LT	PAD PARB DG Research AARI Universities	<ul style="list-style-type: none"> • Carry out review and diagnostics of existing Research System including PARB, DG Research, AARI and Universities • Independent review of completed research projects and outcomes • Engage all stakeholders for 	<ul style="list-style-type: none"> • Rationalize manpower of research institutions and professionalize it according to research themes and strands • Incentivize research scientists and associated manpower • Increase funding for research and appropriate adjustment in procurement rules in consultation with FD 	<ul style="list-style-type: none"> • Promotion of demand driven and quality applied research for increasing productivity and dealing with other challenges • Professionally managed PARB and agriculture research in the

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/Verification
		<ul style="list-style-type: none"> • Develop standards for various commodities and entrust expanded role to Commodities Boards • Move from supply driven to demand driven research 			<p>wider consultations</p> <ul style="list-style-type: none"> • Recast PARB Law to mandate it for better prioritization of demand driven research and coordination and to professionalize its management as well as the Board • Focus on competitive grants for prioritized research • Ensure effective coordination between PARB and Commodity Boards to build value chains of different commodities and build public awareness 		<p>province</p> <ul style="list-style-type: none"> • Home grown solutions to domestic challenges facing agriculture

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/Verification
Crop Diversification and Horticulture	Diversification towards horticulture including vegetables, fruit, pulses & condiments	<ul style="list-style-type: none"> Establish a Punjab Horticulture Research and Development Corporation or Institute (PHRDC) Higher allocation for High Value Agriculture and improve knowledge of farmers about horticulture and crop diversification 	MT-LT	PAD DG Research DG Extension	<ul style="list-style-type: none"> Review and identify potential of high value agriculture in Punjab Explore the potential demand for HVA following operationalization of CPEC Prepare a comprehensive plan including measures and funding needed to implement the plan. The plan may also include the possibility of branding and marketing collaboration between the two private sectors (China and Pakistan) Prepare PC-I in consultation with stakeholders for establishing PHRDC or Institute Drafting and approval of required law, if any. Funding of the institute and the plan through ADP 	<ul style="list-style-type: none"> Improve professional skills of core staff to commission research in HVA & Horticulture Retrain Extension Field Staff for better training in HVA and horticulture to better equip the farmers for moving towards HVA and post-harvest techniques 	<ul style="list-style-type: none"> Shift from staple crops to HVA in line with changing trend in food consumption Higher income for farmers Higher growth of Agriculture sector

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/Verification
					<ul style="list-style-type: none"> • Divert part of savings from subsidies towards HVA and promote agribusiness • Communicate with farmers about economic and financial benefits of HVA, HAV techniques and better post-harvest management techniques 		
Modernizing Agricultural Output Markets	Modern and well- functioning Agricultural output markets are essential for aggregating output, fostering price recovery, and ensure quality is critical	<ul style="list-style-type: none"> • Develop and design Food Outlook System for timely information about commodity demand and pricing • Approval and 	ST-MT	PAD Directorate of Ag Economics and Marketing/ Crop Reporting Services	<ul style="list-style-type: none"> • Develop credible data base for all crops, commodity arrival and pricing • Design Food Outlook that provides forecasts of production, estimated surplus or shortages, prices of key commodities • Implement Bi-annual Food outlook and disseminating it through ICT based extension and CAPP using Directorate of Information and Extension 	<ul style="list-style-type: none"> • Strengthen the capacity of CRS and Directorate of Marketing and Information • Improve the quality of data collection and build data base 	<ul style="list-style-type: none"> • Evidence based demand for various commodities and informed decision by farmers for cropping • Smoothening market functioning

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/Verification
		<p>implementation of Punjab Agricultural Marketing Regulatory Authority (PAMRA) Act, 2017</p> <ul style="list-style-type: none"> Establish a Warehouse Receipt System for key crops in the province 	<p>ST-MT</p> <p>ST-MT</p>	<p>PAD</p> <p>PAD</p>	<ul style="list-style-type: none"> Design systems that permit accurate daily price and quantity reports and better grades and standards evaluations Complete stakeholders consultations on the proposed draft law Enactment of the law through Provincial Cabinet and Assembly Create required infrastructure for enforcement of the law Necessary measures to complete the transition to new law Assess future roles of traditional assemblers and wholesalers (artis and Pharias) and take decision either formalize the system or eliminate 	<ul style="list-style-type: none"> Build capacity of Agriculture Marketing Directorate to regulate these markets and establish regulatory set-up Develop programs to connect markets using ICT based products. Hire professional manpower with experience in banking and agri-business markets Alternately, enter into banking arrangements with some bank Training of the manpower to fulfil the requirements of the system It requires well trained and experienced staff as they will be dealing with public money relating to perishable 	<ul style="list-style-type: none"> Enable private sector managed output markets Establishing farmers' markets Gradual phasing-out of public sector markets Develop quality standards for commodities & encourage value chain development Build holding capacity of farmers to get the right price for their output

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/Verification
					<p>it</p> <ul style="list-style-type: none"> • Review and update the legal framework and notify the same for introducing warehouse receipts system formally • Decide the location of concerned authority within PAD and hire its management 	crops	
Seed Sector Reform	Access to quality seed and timely availability is critical for improved yield and production	<ul style="list-style-type: none"> • Enact the law to ensure competitive environment for availability of good quality seeds with participation of the provincial and private sector and to provide regulatory and enforcement mechanism • Establish a new Punjab Seed Authority (PSA) and Testing Labs at Divisional level and Provincial HQ 	ST-MT	PAD Private Sector Seed Council	<ul style="list-style-type: none"> • Assessment the existing capacity of private and public sector for multiplication and producing certified seed • Review the capacity of Breeders for multiplication and production of quality seed • Identify the gaps • Draft the required law to regulate production of quality seed and protection of 	<ul style="list-style-type: none"> • Hire enforcement staff as well as staffing testing labs • Training of enforcement teams and testing teams • Train prosecution teams and trial courts 	<ul style="list-style-type: none"> • Enabling environment for private sector investment in seed sector • Availability of quality seed at competitive price • Higher yield and productivity • Check against malpractices, monopoly, and private sector participation in

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
					<p>breeders' rights in consultation with the federal and provincial governments stakeholders and the private sector</p> <ul style="list-style-type: none"> • Enact law after approval of the provincial cabinet and the Assembly • Test the new seed system on pilot basis and provide transition period to completely shift to new system' • Establish required infrastructure for enforcement of law • Establish prosecution system • Public awareness campaign • Allocate needed funds 		<p>seed multiplication and production</p> <ul style="list-style-type: none"> • Protection of Breeder's rights

Policy Area	Brief Description	Proposed Actions	ST/ MT/ LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
		Create a warehouse receipt system for key crops	LT		<ul style="list-style-type: none"> Define seed companies to be seed variety producers and enlist/register them Allow truth in labelling for capable companies, and make registration compulsory for companies who cannot qualify for truth in labelling. Truth-in-Labelling tested on pilot basis for selected crops and extended after evaluation. 		

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
Water Management	In view of changing scenarios, focus on increasing water productivity and mainstreaming climate change in irrigation practices as well as better flood management is critical	<ul style="list-style-type: none"> • Estimation of water demand and preparation of contingency plans • Conservation of surface and underground water 	<p>ST-MT</p> <p>ST-MT</p>	<p>PAD PID OFWM</p> <p>PAD PID OFWM</p>	<ul style="list-style-type: none"> • Assess crop-wise water demand, annual water availability, estimate shortages or surplus and prepare contingency plan to deal with the situation • Data may be collected on regular basis • Approval of Provincial integrated water policy by the provincial Cabinet and its notification • Improve the DPR of canals and watercourses • Finalize and approve Underground Water Management law • Rationalize Water pricing Policy to meet M&R Expenditure • Demarcation of the Critical groundwater 	<ul style="list-style-type: none"> • Build Capacity of Water Management and Training Institute to evaluate usefulness and cost-efficiency of new irrigation and water harvesting technologies for local use and production • Retrain extension wing field staff in use of water efficient techniques for training the farmers • Awareness Campaign 	<ul style="list-style-type: none"> • Enhanced water conservation and security • Efficient use of water resources • Enhanced water productivity • Preserving groundwater aquifer • Attracting private investment in local production of water efficient technologies at affordable rate • Private sector investment in providing post-installation services

Policy Area	Brief Description	Proposed Actions	ST/ MT/ LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/ Verification
		<ul style="list-style-type: none"> Promote the use of water efficient technologies in irrigation 	MT-LT	PAD PID OFWM	areas of the Punjab <ul style="list-style-type: none"> Publish the groundwater zoning map Establish an electronic geo-referenced database for tube wells Register all existing tube wells in Punjab including their geographical coordinates No fresh permission for installing tubewells in rain-fed or irrigated areas Detach water rights from land holding Expand the scope of PIPIP to include expansion of water efficient technologies for agriculture Enabling environment for private sector 		<ul style="list-style-type: none">
		<ul style="list-style-type: none"> Take Steps for rain-harvesting and water storages 	ST-MT	PAD OFWM			
		<ul style="list-style-type: none"> Dis-incentivizing water intensive crops 					

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		<ul style="list-style-type: none"> Better coordination for flood control works and disaster preparedness 	ST-MT	PAD OFWM DG Extension	<ul style="list-style-type: none"> investment in local production of irrigation water efficient technologies Enabling environment for private sector investment to provide post-installation services 	<ul style="list-style-type: none"> Extension field staff as well as CRS staff to be equipped to determine this. Also to be trained for its enforcement 	
			ST-MT	PID PAD OFWM PDMA NDMA	<ul style="list-style-type: none"> Train OFWM staff in rain-harvesting and water storages techniques Dissemination of knowledge through OFWM staff and extension staff Review the water demand by water intensive crops in the province Workout the exact demand of such crops to meet the domestic requirements Restore the crop 		

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					zoning system. <ul style="list-style-type: none"> • Shift from policy interventions that directly or indirectly promote cultivation of water intensive crops • Ensure timely dissemination of weather updates and information, develop and deploy early warning mechanism for the farmers 		
Mainstreaming Climate Change in Agriculture and Irrigation and adaptation to climate smart agriculture	Pakistan, though one of the lowest emitter of GHG, but climate change is affecting water availability and therefore needs adaptation strategies in agriculture and irrigation	Establish an Institute for Climate Smart Agriculture (ICSA)	MT-LT	PAD PID DG Research DG Extension PARB	<ul style="list-style-type: none"> • Preparation and Approval of PC-I in coordination with PID & Private sector • Allocation of Funds • Hire professional and technically sound faculty for training and management • Train farmers in adapting climate smart agricultural techniques and 	<ul style="list-style-type: none"> • Institutional Capacity building of Agriculture department on Climate Smart Agriculture Techniques 	<ul style="list-style-type: none"> • Adaptation of climate smart techniques in agriculture and irrigation • Use climate resilient seed/plant varieties for agriculture

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					practices including water use and other inputs such as fertilizers, pesticides • Introduce climate resilient varieties in collaboration with PARB and PARC		
		Collaborate with Livestock Department and EPA to reduce GHG emissions from Livestock and Agriculture	MT-LT	PAD Livestock Department, EPA	<ul style="list-style-type: none"> • Ensure safe capture, transport, and storage and appropriate application of manure • Focus on production of high-quality feed from agriculture for livestock • Introduce new breeds of livestock • Review Livestock Policy for incorporating climate sensitive actions 		
Investment	To provide incentives for private sector	• Establish Agribusiness and Innovation Fund	ST-MT	PAD FD P&D	• Preparation and approval of PC-I	Capacity to develop business model for managing the fund and	• Increased value addition

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	investment in agriculture, investment in agribusiness, value addition and agriculture technology	<p>along with its governance structure</p> <ul style="list-style-type: none"> • Design incentive structure to attract private sector investment in all agriculture inputs 	MT-LT	PAD FD P&D	<ul style="list-style-type: none"> • Establish the Fund and allocation of resources • Notifying governance structure for the Fund • Develop matching grant operational manual including proposals' evaluation criteria • Attract investors in agribusiness through public calls for proposals • Evaluate proposals and extend grants to successful applicants • Preference to rural women and youth • Prepare incentive structure to attract private sector investment in all agriculture inputs in consultation with 	evaluation of proposals	<p>of agri-products and use of innovative technology</p> <ul style="list-style-type: none"> • Increased private sector investment in Agriculture • Increased employment opportunities

Policy Area	Brief Description	Proposed Actions	ST/MT/LT	Action Centre ¹⁸	Proposed Process	Capacity Building	Outcomes/Verification
					the federal government/FBR and private sector such as HEIS technology, Climate resilient seed varieties, quality seeds, extension services hubs, research, etc.		
Change Management	To implement this agriculture policy and build the required capacity, leadership, effective communication and change management are essential elements	<ul style="list-style-type: none"> Implement the Plan for change management rationalizing span of control, delegation of powers, and build capacity where necessary 	ST-MT	PAD FD	<ul style="list-style-type: none"> Review the existing structure of PAD Change the structure to rationalize span of control, empowerment for prompt decision-making, and create necessary structure for emerging issues Delegation of Power at each level Create mechanisms for inter-departmental, intra-department policy and coordination mechanisms for effective planning 	<ul style="list-style-type: none"> Prepare a comprehensive plan to build the capacity of the department and train them in modern techniques of management as well as change management and leadership 	<ul style="list-style-type: none"> An efficient and productive government department equipped to deal with emerging challenges and implement the Agriculture Policy.

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					<ul style="list-style-type: none"> Strengthen Planning, Finance and Internal Audit wings of the department Institutionalize ADU Rationalize Human Resource management and incentive structures for each cadre functioning in the department Provide requisite technology for ICT based communication & decisions 		
Effective Communication and Monitoring and Evaluation for management decision-making	The success of Agriculture Policy depends upon evidence based Planning geared towards bridging the gaps identified which needs results based monitoring and evaluation system as well as an effective communication strategy	<ul style="list-style-type: none"> Design intra and inter department as well as mass communication policy and strategy Develop & implement ICT based management and performance monitoring and evaluation in the department 	ST-MT	<p>PAD DG Extension PM&E Department</p> <p>PM&E Cell</p>	<ul style="list-style-type: none"> Prepare a Diagnostic and Design Report for developing communication Policy and Strategy as well as establishing M&E System Prepare PC-I to include required manpower and need technological equipment and 	<ul style="list-style-type: none"> PAD to hire required manpower Arrange for department-wise, specially the field staff, training in ICT and use of system <p>Strengthen PM&E in terms of manpower and capacity building</p>	<ul style="list-style-type: none"> Evidence based decision making and planning and implementation Prompt and effective management decision-making through

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		<ul style="list-style-type: none"> • Upgrade PM&E Cell to an Attached Deptt. 			allocation of resources <ul style="list-style-type: none"> • Operationalize the systems and starts collecting requisite data and information • Expansion of Planning, Monitoring and Evaluation Cell 		Dashboard <ul style="list-style-type: none"> • Performance based HR System