Innovations for Agriculture Modernization
Technical Assistance Concept Paper

Date: 5 November 2013

1. Country partnership strategy (CPS) / Regional cooperation strategy (RCS):
   - Year included in CPS/RCS/COBP/ROBP/CPS or RCS Midterm Review Report: The Government of Uzbekistan requested ADB on 3 October 2013 for technical assistance for Innovations for Agriculture Modernization including support for crop diversification and cotton harvest mechanization. The TA will complement the recently approved Amu Bukhara Irrigation System (ABIS) Rehabilitation Project.
   - Document reference number and date approved: Not applicable
   - In case of change in the TA title, type, or amount, please state reason: Not applicable

2. TA Type
   - ☐ CDTA ☐ R- CDTA
   - ☐ PATA ☐ R- PATA
   - ☒ RDTA ☐ R- RDTA

3. Modality:
   - ☐ Cluster
   - ☒ sovereign ☐ non-sovereign

4. Categorization of TA: ☐ Category A TA ☒ Category B TA

5. Coverage
   - ☒ Country ☒ Subregional ☐ Interregional
   - Demonstration farms in Bukhara and Navoi provinces, Uzbekistan

6. For RDTA: Medium Term Corporate Strategic Priorities for Research
   - ☒ Promoting Inclusive Growth
   - ☒ Addressing Climate Change
   - ☐ Regional Integration
   - ☐ Address increasing commodity price
   - ☐ Demographic Change
   - ☐ Other

7. Assistance Focus

   a. Sector(s):
   - ☒ Agriculture and natural resources
   - ☐ Education
   - ☐ Energy
   - ☐ Finance
   - ☐ Health and social protection
   - ☐ Industry and trade
   - ☐ Public sector management
   - ☐ Transport and ICT
   - ☐ Water supply and other municipal infrastructure and services
   - ☐ Multisector

   Subsector(s): Agricultural production and markets

   b. Targeting classification
   - ☐ Targeted intervention
     - ☐ TI-H ☐ TI-M ☐ TI-G
   - ☒ General intervention (more indirectly addressing poverty reduction)

   c. Theme(s)
   - ☒ Economic growth
   - ☐ Social development
   - ☐ Environmental sustainability
   - ☐ Regional cooperation and integration
   - ☐ Gender equity
   - ☒ Private sector development
   - ☐ Governance
   - ☐ Capacity development

   Subthemes: Widening access to markets and economic opportunities; promotion of private sector investment

   d. Location impact

Relative weight of spatial impact of the project	High	Medium	Low
Rural	☒	☐	☐
Urban	☐	☐	☒
National	☐	☒	☐
Regional	☐	☐	☒

8. Partnership: Not applicable but may find partners during the TA fact finding mission

9. Name of the Specialist (project co-team leader) in charge of the project: Jiangfeng Zhang	Name of the Specialist (project co-team leader) in charge of the project: Ryutaro Takaku
• Local Number: 6942	• Local Number: 5158
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10. Department/Division: RSDD-AR and CWRD/CWER	

11. Key Development Issues to be addressed:

Uzbekistan registered strong economic growth between 2000 and 2011 with an average annual growth rate of 9.5%. This was largely due to the increasing growth and share of the industry and service sectors to the gross domestic product (GDP) and in turn, the declining share of the agriculture sector. Despite this downtrend, the agriculture sector continues to play a significant role in Uzbekistan's economy. In 2011, agriculture contributed close to a fifth of GDP, and employed about 27% of the country's total labor force.[1] While the national level of low income population has declined from 21.8% in 2008 to 17.7% in 2010, 18.5% of the rural population is still low income population.[2] With around 50% of the country's population living in the rural areas, this means that about 60% of the total poor are in rural areas; majority of them are dependent on agriculture for living. The rural poor spend 53% of their income on food, compared to 33% by the urban residents.[3]

Uzbekistan's agriculture sector is largely dominated by cotton and wheat farming.[4] In 2012, the two crops were inter-cropped in about 70% of total cultivated area, producing 48% of the sector's total production and accounting for 30% of rural employment. It is also a main water-consuming subsector.[5] Uzbekistan has maintained its status of being one of the world's largest exporters and producers of cotton. In 2011, it ranked fifth among the world's major cotton exporters. Wheat production is largely supported by the government's food self-sufficiency program. Both cotton and wheat are government controlled through state governed procurement, pricing, processing and marketing policies. While government has reduced procurement quotas for the various commodities, it maintains strong influence on the cotton supply chain. Export revenues from the cotton subsector contributed to financing the government's import substituting policies and cushioned the economy from world commodity price volatility.

Other important crops are fruits, nuts, vegetables, and fodders, which receive less government involvement. In 2011, agriculture sector grew by 6.6%, supported by fruit and vegetable production and livestock breeding.[6] Uzbekistan's agriculture sector provides 90% of domestic demand for agriculture products and 70% of domestic trade.[7] However, the country remains to be a net food importer, except in fruit and vegetable products.

The Government's Welfare Improvement Strategy for 2013-2015 (WIS-II) aims to reduce the nation's level of low income populations from 17.7% in 2010 to 13.7% by 2015. This will be achieved primarily through enhanced rural labor efficiency, combined with income generating activities through improved infrastructure and food and agriculture-based development. These twin approaches will in turn necessitate the accelerated implementation of key reform measures, namely: (i) further structural reforms of the agrarian sector and the diversification of agricultural production; (ii) further modernization and the technical renewal of the agrarian sector, infrastructure and agribusinesses; (iii) more effective use of land and water; and (iv) increase of the financial stability of farm entities and the liberalization of agricultural policy.

ADB's recently approved ABIS Rehabilitation Project contributes in part to these strategic measures. The Project will upgrade existing and construct new irrigation infrastructure, promote efficient water use management, and diversify crops in the ABIS command area of about 250,000 hectares (ha) in the Bukhara and Navoi provinces[8] where cotton, wheat, fruits, vegetables and fodders are produced. They are necessary, albeit not sufficient conditions to enhance rural labor efficiency and improve farm incomes that will guarantee the achievement of the WIS-II goal of poverty reduction.

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1 European Union. 2013. *Uzbekistan: Selected Trade and Economic Issues*. Brussels.
2 Republic of Uzbekistan. 2013. *Welfare Improvement Strategy of Uzbekistan (2012-2015).* Tashkent.
3 World Food Programme. 2008. Poverty and Food Insecurity in Uzbekistan. Rome.
4 N. Djanibekov, I. Rudeko, J.P.A. Lamers and I. Bobojonov. 2010. *Pros and Cons of Cotton Production in Uzbekistan*. Cornell University, Ithaca, New York.
5 ADB. 2011. *Technical Assistance to the Republic of Uzbekistan for Preparing the Amu Bukhara Irrigation System Rehabilitation Project*. Manila.
6 Food and Agriculture Organization of the United Nations. 2013. *Eastern Europe and Central Asia Agro-Industry Development Country Brief.* Rome.

For this, accompanying measures will be implemented such as: (i) more efficient farm production practices like the use of high yielding and drought or salt tolerant varieties and laser leveling, (ii) the use of appropriate machinery and technologies at pre- and postharvest stages, and (iii) importantly, the implementation of market-based pricing and marketing arrangements especially in the cotton and wheat farming system. Strong government intervention in what, how, and for whom to produce cotton and wheat, has served as the major deterrent to improving the welfare of rural farm households. While the government is still committed to pursuing strong influence on the cotton value chain, there is a need to demonstrate to government that there are alternative integrated approaches to sustainable farming that would maximize cotton-wheat-high value crop production through more efficient and effective use of land and water while employing rural labor in more socially beneficial fashion.

Higher cotton production and revenues can be achieved with less land and water than is presently used. Land freed from cotton cultivation can be diversified into production of more suitable and climate-resilient high value crops (HVCs). Improved agronomic practices will likewise address the problem of land degradation and other environmentally associated concerns. Further, with the employment of international practices, institutional arrangements like outgrowers' schemes with major agribusinesses, cotton farmers may be able to meet their production targets with less land and water used, and increase their agriculture incomes from an integrated cotton-wheat-HVC farming system. Producing more cotton with less use of land and water can help reduce adaptation deficit, equivalent to 1.4 tons per ha.[9] The Government has a strategy to reduce reliance on cotton and promote higher value crops.

More importantly, mechanized farming and harvesting of cotton will make the engagement of school youths, women, and forced labor an obsolete practice especially during harvesting season. Some studies showed that mechanical harvesting can be done continuously with less time constraints, produce the same quality and less waste than hand picking, and is hygienic.[10] These would have important bearing on the international concern for the use of child/forced labor during cotton harvesting season in Uzbekistan. In response to concerns raised by civil society and others, the Government has accepted for the first time that the International Labour Organization (ILO) undertake joint monitoring on labor issues during the cotton harvest season in 2013. ADB is coordinating closely with the ILO, as well as other development partners on this matter. The government has a 5-year plan for cotton harvest mechanization to help address these labor issues.

Uzbekistan women will benefit from mechanization in particular and more efficient integrated farming system in general. They perform multifarious roles aside from household chores. Specifically, they work in cotton and wheat fields from cultivation to harvesting. They also take care of the dekhan farms, which are the main source of cash income of farm households. Mechanization will help not only eliminate child/forced labor but also reduce the burden of women in cotton production and harvesting. This will help reduce the number of hours women spent on the farm and ensure more time is spent for children, including sending them to school. On the other hand, crop diversification will augment the farm household income. With more income from crop diversification, the family will have more cash to purchase nutritious food.

12. TA Description;

a. Link to Country Partnership Strategy/Regional Cooperation Strategy:

The TA supports the WIS-II and the Government's commitment to enforce international labor standards, specifically by addressing the desired outcomes of the strategy for agriculture: (i) structural reforms of the sector deepened through crop diversification; (ii) improvement of crop productivity with among others farming mechanization; (iii) cooperation between government and farmers producing cotton quotas strengthened and cotton area reduced; and (iv) engagement of private agribusinesses expanded.

The TA is consistent with the Country Partnership Strategy (CPS) (2012-2016) for Uzbekistan which supports its transformation into a modern industrial and service economy through sustained and inclusive growth, a reduction in poverty, and expanded regional cooperation. To help improve the business environment in Uzbekistan, the CPS specifies ADB providing demand-led TA in areas identified jointly with the government.

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[7] International Fund for Agricultural Development. 2012. *President's Report: Proposed Loan and Grant to the Republic of Uzbekistan for the Horticultural Support Project.* Rome.

[8] ADB. 2013. *Report and Recommendation of the President on the Proposed Loans to Uzbekistan for the Amu Bukhara Irrigation System Rehabilitation Project.* Manila.

[9] ADB estimates the figure as the difference of production per ha under similar cotton lands in PRC which produce 4.0 tons per ha versus Uzbek cotton land that garner 2.6 tons per ha.

[10] http://repository.cimmyt.org/xmlui/bitstream/handle/10883/874/34615.pdf

b. Impact:
The TA impact will be expanded mechanization of cotton farming and diversification to high value crops in Uzbekistan.

c. Outcome:
The TA outcome will be improved cotton-wheat-high value crop farming system in demonstration farms.

d. Outputs
The outputs of the TA will be: (i) mechanized cotton farming with good agronomic practices and post-harvest processing demonstrated in pilot farms; (ii) modernized techniques in producing HVCs demonstrated in pilot farms; and (iii) protocols and procedures for mechanization and crop diversification developed.

Cotton Mechanization. The TA will demonstrate mechanization techniques and sound agronomic management practices that will ensure sustainable and profitable cotton and wheat farming systems in demonstration farms. One way to demonstrate mechanization is through private sector support for the provision and use of appropriate farm machinery and other implements, as well as advisory/extension services through the pilot testing of contracting arrangements. The key mechanization aspects will focus on energy-efficient farm machinery and technologies that will reduce the need for larger cotton area, improve the soil health of the cotton and wheat areas, optimize water application, and reduce the current labor use especially in the harvesting of cotton. Agronomic management practices may use high yielding and climate-resilient cotton varieties, laser leveling, improved tillage practices, proper seeding and fertilizer use, techniques for efficient water use, and efficient labor use from cultivation to harvesting stages. The proposed integrated cotton and wheat farming system approach will demonstrate improved productivity and profitability through judicious use of land, water, and labor. The TA will also identify an institutional approach to provision of equipment, e.g. lease finance of machinery.

Crop Diversification. The integrated and sustainable approach to cotton and wheat will be complemented with an inter−or multi−crop in the proposed reduced cotton area. Specifically, the lands freed up from cotton mechanization will be used for growing identified geographically and climate suitable fruits or other HVCs with proven market demand and high profitability. Techniques and practices such as integrated pest management, herbicide effectiveness, reduced and zero tillage, green and organic manure application, and mechanization for cultivation, harvesting, and post-harvesting handling techniques will be demonstrated in the proposed cotton-wheat-HVC farming system.

Protocols and Procedures Development. Based on the results of pilot testing and demonstrations, the TA will study the socio-economics of cotton mechanization and crop diversification, with focus on the opportunity costs on land, water, energy, and labor as well as the social implications of machinery replacement of rural labor. Environmental and climate change impacts of the proposed integrated cotton-wheat-HVC farming system will be examined. Good practices and knowledge developed and lessons learned will be used for developing protocols and procedures for the appropriate up-scaling of the mechanization and crop diversification programs of the government.

The good lessons learned from the proposed TA will also be replicated in the farm demonstration component for crop diversification and climate change adaptation of the ABIS Project.

13. Assumptions and risks:
The major assumptions are that: (i) the government supports mechanized cotton farming and harvesting and the conversion of cotton farm lands to grow HVCs; (ii) the demonstration farm situation of low productivity and excessive use of land, water, and labor in cotton farms is representative of the cotton farms in Uzbekistan; and (iii) local governments support the relaxation of cotton and wheat production quotas for the selected demonstration farms. The risks are: (i) the Government's weak enforcement of the international labor standards; (ii) climate change has serious adverse effects in project area; and (iii) the government is not transparent in the determination of participating farmers' net revenues for cotton produce.

14. Implementation Arrangements
a. Proposed executing/implementing agency (EA/IA): Ministry of Agriculture and Water Resources (MAWR)
ADB will be responsible for overall TA management and coordination.
b. Institutional/organizational/procurement/financial management assessments on the EA/IA previously conducted

☒ Yes ☐ No

MAWR is the EA for the ABIS Rehabilitation Project, and has been working on projects financed by ADB, International Fund for Agricultural Development, and the World Bank.

c. ADB inputs

ADB will provide inputs of 13 person-months of international consulting services and 39 person-months of national consulting services covering agriculture science, agriculture engineering, and marketing. The consultants will be recruited through a firm using quality- and cost-based selection with a ratio of 80:20. The TA proceeds will be disbursed in accordance with ADB's *Technical Assistance Disbursement Handbook* (2010, as amended from time to time). All procurement will be carried out in accordance with ADB's Procurement Guidelines (2013, as amended from time to time), and consultants will be recruited in line with ADB's *Guidelines on the Use of Consultants* (2013, as amended from time to time).

d. Complementary inputs to be provided by Government and/or other TA providing agencies

The government will provide office accommodation, remuneration and per diem of counterpart staff, and counterpart travel. The government will also provide a resolution instructing the local district officials to relax their cotton area and quota stipulations on the farmers participating in the demonstration plots.

15. Nature/extent of government/beneficiary involvement in identifying or conceptualizing the assistance:
The Government of Uzbekistan was involved in identifying the assistance.

16. Cost Estimates and Proposed Financing Arrangements

The TA is estimated to cost $1,200,000, of which $1,000,000 will be financed on a grant basis by ADB's Technical Assistance Special Fund (TASF-others). The government will provide in-kind contribution equivalent to $200,000 in the form of counterpart staff, office accommodation, secretarial assistance, and domestic transportation for counterpart staff.

Source	**Amount** ($)
ADB Financing	
TASF-others	$1,000,000
Government Financing (in-kind)	$200,000
Total Cost	$1,200,000

Source: Asian Development Bank estimates.

17. JSF Amount Requested $0

18. Monitoring and Evaluation

Monitoring and evaluation are integral to the design and implementation of the TA. In coordination with MAWR, a baseline assessment at TA inception, and outcome evaluation at TA completion will be undertaken. Provincial and district statistics will be verified and validated in terms of veracity and credibility in their use for monitoring and assessing the outcome and impact targets.

19. Estimated period of TA implementation:
    a. Approval of TA: December 2013
    b. Physical completion of TA: December 2016
    c. Closing of TA: June 2017

PRELIMINARY DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets/Indicators	Data Sources/ Reporting Mechanisms	Assumptions and Risks
Impact Expanded mechanized cotton farming and diversification to HVCs in Uzbekistan	Mechanized cotton farms increased by 50% in ADB's ABIS area and by 20% in Uzbekistan by 2018 (baseline: to be collected and targets to be verified during fact finding mission) Area for cotton reduced and area for HVCs increased by 30% by 2018 (baseline: to be collected and targets to be verified during fact finding mission)	Province and district statistics M&E and project management office reports of the ABIS Project	**Assumptions** • The government supports mechanized cotton farming and harvesting and the conversion of cotton farm lands to grow HVCs. • The demonstration farm situation of low productivity and excessive use of land, water, and labor in cotton farms is representative of the cotton farms in Uzbekistan. **Risk** • Government's weak enforcement of the international labor standards
Outcome Improved cotton-wheat-HVCs farming system in demonstration farms	Average cotton yield increased by 15% at the demonstration farms by December 2016 (baseline: 3.2 tons per hectare in 2012) Average wheat yield increased by 5% at the demonstration farms by December 2016 (baseline: 6.0 tons per hectare in 2012) Average water use reduced by 20% at the demonstration farms by December 2016 (baseline: 8,660 m^3 in 2012) Average labor use reduced by 50% at the demonstration farms by December 2016 (baseline: 55 workdays per hectare in 2012)	TA M&E reports to MAWR	**Risk** • Government is not transparent in the determination of participating farmers' net revenues for cotton produce
Outputs 1. Mechanized cotton farming with good agronomic practices and post-harvest processing demonstrated in pilot farms	150 hectares of contiguous private farms selected for demonstration (by September 2014) Contracting arrangements between demonstration farms and machinery suppliers concluded, and appropriate machinery in cultivation and harvesting identified and applied (by June 2015) Financial and institutional mechanism identified for provision of machinery (by 30 June 2015) 500 farmers from demonstration and adjacent farms trained and received toolkits on mechanization techniques and agronomic practices (by December 2016) Demonstration farms adopting high yielding	TA M&E reports to MAWR	**Assumption** • Local governments support the relaxation of cotton and wheat production quotas for the selected demonstration farms **Risk** • Climate change has serious adverse effects in project area.

	and drought resistant cotton and wheat varieties, laser leveling, improved tillage practices, proper seeding and fertilizer use, techniques for efficient water use (by December 2016)		
2. Modernized techniques in producing HVCs demonstrated in pilot farms	Suitable HVCs with proven market demand and high profitability identified (by September 2014) 100 farmers from demonstration and adjacent farms trained on HVC techniques (by December 2016) Demonstration farms adopting techniques and practices such as integrated pest management, herbicide effectiveness, reduced and zero tillage, green and organic manure application, and mechanization for cultivation, harvesting, and postharvesting handling (by December 2016)		
3. Protocols and procedures for mechanization and crop diversification developed	Report on savings on land, water, energy, and labor endorsed by MAWR (by August 2016) Report on economics of mechanized cotton-wheat-HVC farming system presented in national and international workshops and endorsed by MAWR for publication (by August 2016) Protocols and procedures endorsed by MAWR (by December 2016)		

Activities with Milestones	**Inputs**
1.1 Consultants recruited and fielded by 30 June 2014. 1.2 Demonstration farms identified by 31 July 2014. 1.3 Contracting arrangements with demonstration farms, private sector machinery providers and agribusinesses completed by 31 October 2014. 1.4 Appropriate machinery in cultivation and harvesting identified (by 31 October 2014) 1.5 Piloting and demonstration works on cotton mechanization undertaken (from 1 November 2014 to 30 June 2016) 1.6 Identification of financial and institutional mechanism for provision of machinery (e.g., lease finance) completed by 30 June 2015 1.7 Workshops on good agronomic techniques and agriculture machinery usage provided in ABIS Rehabilitation project sites done between 1 January 2016 and 30 April 2016 1.8 Tool kit and good practices and lessons learned materials completed by 31 May 2016 2.1 Suitable HVCs with proven market demand and high profitability identified (by 30 September 2014) 2.2 Piloting and demonstration works on crop diversification undertaken (from 1 November 2014 to 30 June 2016) 3.1 Baseline survey completed and M&E system established (by 31 August 2014) 3.2 Dialogues with the government on reforms that would incentivize agriculture sector in the use of mechanization and good agronomic management practices in cotton and wheat farming systems conducted regularly between 1 August 2014 and 31 October 2016 3.3 Research team engaged to study economics of cotton mechanization and crop diversification including savings on land, water, energy, and labor (from 1 July 2016 to 30 September 2016)	• ADB: $1,000,000 (TASF-others) • Government (in-kind): $200,000

3.4 Protocols and procedures for up scaling mechanization and crop diversification submitted to MAWR (by 30 September 2016) 3.5 Research team engaged to evaluate TA outcome (from 1 September to 31 October 2016)	

ABIS = Amu Bukhara Irrigation System, ADB = Asian Development Bank, HVCs = high value crops, MAWR = Ministry of Agriculture and Water Resources, M&E = monitoring and evaluation.

COST ESTIMATES AND FINANCING PLAN

($)

Item	Total Cost
Asian Development Bank (ADB) Financing[a]	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	325,000
ii. Domestic Consultants	234,000
b. International and Local Travel	50,000
c. Reports, Translation, and Communications	5,000
2. Equipment[b]	100,000
3. Demonstration and Field Services	75,000
4. Training and Workshops[c]	50,000
5. Surveys and Studies	50,000
6. Miscellaneous Administration and Support Costs[d]	36,000
7. Contingencies	75,000
Total	**1,000,000**

Note: The technical assistance (TA) is estimated to cost $1,200,000, of which contributions from the Asian Development Bank are presented in the table above. The government will provide in-kind contribution equivalent to $200,000 in the form of counterpart staff, office accommodation, secretarial assistance, and domestic transportation for counterpart staff.

[a] Financed by the ADB's Technical Assistance Special Fund (TASF-others).
[b] Including office and field equipment such as rippers, ploughs, cultivators, planters, bed harrows, fertilizer rigs, spray rigs, laser leveling bucket and associated electronics. After completion of the technical assistance, equipment will remain with the institutes involved in the technical assistance.
[c] Including translation and interpretation costs.
[d] Including, for example, field and office supporting staff, office supplies, stationaries.
Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

1. The technical assistance (TA) will require 13 person-months of international consulting services and 39 person-months of national consulting services. The consultants will be recruited through a firm using quality- and cost-based selection with quality-cost ratio of 80:20. The consultant team will need to submit (i) an inception report within 1 month of fielding; (ii) quarterly progress reports; (iii) draft final report by October 2016; and (iv) final report acceptable to the Asian Development Bank (ADB) by December 2016. For each report, the consultant team needs to submit three copies each to ADB and the government respectively, in both English and Russian.

1. Agriculture Specialist (international / team leader, 9 person-months)

2. The international agriculture specialist will:
   (i) provide overall team leadership for supervision and coordination of activities of the consultants, including briefing consultants on their arrival and jointly formulating individual work plans consistent with those of the TA and reporting to ADB and the Government;
   (ii) advise ADB and the Government on TA planning and implementation issues and address the issues, and determine priorities and management of TA resources;
   (iii) provide technical supports to the agriculture engineers on the cotton mechanization;
   (iv) introduce and demonstrate most important agronomic practices and crop management, such as but not limited to laser leveling of fields; deep tillage during primary ground preparation; permanent beds and minimum tillage; use of high quality, treated seed; temperature based timing for planting; optimal water allocation and use; pre-plant application of nitrogen and phosphorus; efficient use of labor and mechanization during cultivation and harvesting; timely insect control; and correct preparation of the crop for mechanical harvesting for the cotton-wheat-HVC system;
   (v) jointly with the agriculture engineers link demonstration farms with private sector machinery providers and agribusinesses through contracting arrangements;
   (vi) ensure that environmental considerations and climate change adaptation are fully incorporated in all activities of the TA;
   (vii) together with the international agriculture engineer, develop the protocols and procedures for mechanization and crop diversification;
   (viii) provide technical support and data to the research team on studying the economics of cotton mechanization and crop diversification analysis; and
   (ix) responsible for organizing the preparation of, consultation on, and finalization of the proposed protocols and procedures for large scale mechanization and crop diversification.

3. The international agriculture specialist will have at least a master's degree with specialization in cotton or horticulture (vegetables and fruit), or agricultural economics. The consultant should have at least 15 year experience in resource management, rural development, and farm production and marketing linkages. The consultant should be familiar with ADB project implementation and management procedures, have previous satisfactory experience in leadership, and have relevant work experience in the central and west Asia region.

2. Agriculture Specialist (national, 18 person-months)

4. The national agriculture specialist will:
   (i) introduce and demonstrate most important agronomic practices and crop management, such as but not limited to laser leveling of fields; deep tillage during primary ground preparation; permanent beds and minimum tillage; use of high quality, treated seeds; temperature based timing for planting; optimal water allocation and use; appropriate pre-plant application of nitrogen and phosphorus; efficient use of labor and mechanization

during cultivation and harvesting; timely insect control; and correct preparation of the crop for mechanical harvesting for the cotton-wheat-HVC system;
(ii) provide technical supports to the agriculture engineers on the cotton mechanization;
(iii) jointly with the agriculture engineers link demonstration farms with private sector machinery providers and agribusinesses through contracting arrangements that will ensure sustainable use and maintenance of machinery;
(iv) monitor regularly the crop cultivation and harvesting in the demonstration farm to ensure timely extension and advisory services to farmers, and report regularly to team leader on progress of cotton-wheat-HVC farming system in the demonstration farms;
(v) ensure that environmental considerations and climate change adaptation are fully incorporated in all activities of the TA; and
(vi) provide technical support and data to the research team on studying the economics of cotton mechanization and crop diversification analysis.

5. The national agriculture specialist will have at least a master's degree with specialization in cotton or horticulture (vegetables and fruit), or agricultural economics. The consultant should have at least 10 year experience in resource management, rural development, and farm production.

3. Agricultural Engineer (international, 4 person-months)

6. The international agricultural engineer will
(i) advise the international good practices and technologies on agriculture equipment and machineries which are applicable to Uzbekistan cotton-wheat-HVCs farming and harvesting, and advice needed modifications to fit Uzbekistan situation;
(ii) advise and evaluate the TA's refining, developing, testing, and demonstrating appropriate agriculture equipment and machineries;
(iii) jointly with the agriculture specialists link demonstration farms with private sector machinery providers and agribusinesses through contracting arrangements;
(iv) address the machinery and other technology related concerns during the TA implementation, including need for modifications of equipment and technological practices, maintenance and repair, implications on quality and production volume, and labor use, energy, and water implications;
(v) evaluate the impact of the new techniques on land, water, energy, and labor use;
(vi) together with the team leader, develop the protocols and procedures for mechanization and crop diversification for recommendation to the Government; and
(vii) provide technical support and data to the research team on studying the Economics of cotton mechanization and crop diversification analysis.

7. The international agricultural engineer should have at least a master's degree in a relevant field with at least 15 year experience on agriculture machinery development, use, and dissemination.

4. Agricultural Engineer (national, 18 person-months / deputy team leader)

8. The national agricultural engineer will
(i) assist the team leader on the supervision and coordination of activities of the consultants, reporting to ADB and the Government, and advising ADB and the Government on TA planning and implementation issues and addressing the issues;
(ii) advise the needed modifications of international good practices and technologies on agriculture equipment and machineries to fit Uzbekistan situation;
(iii) advise and evaluate the TA's refining, developing, testing, and demonstrating appropriate agriculture equipment and machineries;

(iv) jointly with the agriculture specialists link demonstration farms with private sector machinery providers and agribusinesses through contracting arrangements;
(v) evaluate the impact of the new techniques on land, water, and labor use; and
(vi) provide technical support and data to the research team on studying the economics of cotton mechanization and crop diversification analysis.

9. The national agricultural engineer should have at least a master's degree in agriculture engineering or relevant field with at least 10 year experience on agriculture machinery development, use, and dissemination.

5. Agriculture and Marketing Economist (national, 3 person-months)

10. The marketing economist will

(i) conduct an initial and detailed review and analysis of the current marketing systems prevailing in Amu Bukhara, Uzbekistan, for cotton-wheat-HVCs particularly fruit and vegetables, and nuts. The review should include current status in meeting domestic and international quality requirements, demand potential for the TA's focus crops, and, the availability of timely and appropriate agricultural marketing information to farmers (men and women);
(ii) carry out value chain analysis for the main HVCs being demonstrated by the TA, gaps identified in the chain, and advise on the forward and backward linkages that may be developed to the benefit of the main farmer beneficiaries, and their groups considering the specific needs and potentials for women;
(iii) conduct farm budget analysis for demonstration farmers to assess the economic and financial viability of adopting the TA's proposed activities; and
(iv) conduct analysis for potential negative impacts from mechanization on wages and employment opportunities for low income population.

11. The specialist should hold a master's degree in agricultural development, economics or marketing and have at least 10 year experience.