



Completion Report

PUBLIC

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India: Support for Agricultural Value Chain Development in Uttar Pradesh

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TECHNICAL ASSISTANCE COMPLETION REPORT

TA Number, Country, and Name: TA 9594-IND: Support for Agricultural Value Chain Development in Uttar Pradesh		Amount Approved: \$225,000.00	
		Revised Amount: Not Applicable	
Executing Agency: Uttar Pradesh State Agricultural Produce Marketing Board	Source of Funding: Technical Assistance Special Fund-Other Sources	Amount Undisbursed: \$68,295.66	Amount Used: \$156,704.34
TA Approval Date: 26 September 2018	TA Signing Date: Not applicable	TA Completion Date	
		Original Date: 30 September 2019	Latest Revised Date: 31 October 2021
		Financial Closing Date: 10 December 2021	Number of Extensions: 3
TA Type: Knowledge and support TA	Nature of Activity: Policy advice	TA Arrangement: Small-scale	

Description

Indian agriculture experienced structural changes shifting from a traditional subsistence-based agriculture to a market-oriented production. India transformed from being dependent on food aid in the 1960's to producing sufficient food, feed and fiber for its large and growing population.¹ This was undertaken largely through the adoption of technology, such as the use of high yielding variety seeds, mechanized farm tools, and irrigation facilities. These changes coincided with greater agricultural diversification in commodities produced, which enabled India to be ranked as one of the largest producers of milk, jute and pulses, and the second largest producer of rice, wheat, sugarcane, cotton, groundnuts, fruit, and vegetables. Despite these developments, the sector continued to face challenges in attaining long-term growth and productivity. These include low and declining average farm sizes, limited participation of farmers in value chains, and high post-harvest losses resulting in low-income for farming households.

In Uttar Pradesh, the state government set a vision in 2013 to transform the state into a 'Granary of the Nation' by ensuring food and nutritional security, and improve the quality of village life through inclusive and sustainable growth.² The government aimed to grow the agriculture sector by 5.1% per year and encourage private sector participation in the field of agricultural research, development, extension, input management and agricultural marketing. The state's policy identified the need to (i) increase the income of farmers through agricultural diversification towards high value activities; (ii) develop infrastructure facilities in sectors of seeds, fertilizers, pesticides, agriculture implements, extension services, food processing, and marketing; and (iii) promote private sector involvement across the agricultural value chain.

This small-scale technical assistance (TA) was approved on 26 September 2018, to support a request from the state to undertake a detailed value chain analysis of select commodities with due attention to (i) increasing farmer incomes, and (ii) identifying constraints on improving the efficiency of existing infrastructure and institutions.

Expected Impact, Outcome, and Outputs

The expected impact of the TA was agricultural value chains of high value crops in Uttar Pradesh strengthened.³ The expected outcome of the TA was recommendations for improved agricultural value chains in Uttar Pradesh prepared. The outputs were (i) market trends for five commodities analyzed, (ii) pre-feasibility study of targeted value chain completed, and (iii) stakeholder capacity on market-oriented value chain development strengthened.

¹ A. Gulati and R. Juneja. 2021. [Transforming Indian Agriculture](#). National Dialogue Indian Agriculture Towards 2030: Pathways for Enhancing Farmers' Income, Nutritional Security and Sustainable Food Systems. 19–22 January.

² Government of Uttar Pradesh. 2013. [Uttar Pradesh Agriculture Policy 2013: Roadmap for Progress and Prosperity](#). Lucknow.

³ The TA supports the Government of Uttar Pradesh's aim to increase the income of farmers through agricultural diversification towards high value activities (footnote 2).

Implementation Arrangements

The Government of Uttar Pradesh designated the Uttar Pradesh State Agriculture Marketing Board (UPSAMB) as the TA's executing agency. UPSAMB was also designated as the coordinator for the interdepartmental committee that comprised representatives from all the relevant primary sector departments, such as the Department of Agriculture, Department of Horticulture, Department of Fisheries, and Department of Dairy and Animal Husbandry. The Asian Development Bank (ADB) administered the TA through the South Asia Department's Environment, Natural Resources and Agriculture Division. ADB was responsible for consultant recruitment and management.

The TA was to engage four individual consultants with the following expertise (i) agribusiness and value chain, (ii) agroecconomics and agricultural policy, (iii) rural infrastructure, and (iv) agricultural marketing, for a planned total of 31.5 person-months inputs. The actual inputs used were 13.81 person-months from three individual consultants: (i) agribusiness and value chain specialist/team leader, (ii) lead market analysis specialist, and (iii) agribusiness and value chain specialist/member. The TA also financed the services of a peer reviewer, editor, and a Hindi translator.

The TA was implemented for 3 years with a cumulative extension of 25 months. The first extension of 6 months up to 31 March 2020 was approved in September 2019 to offset delays in the approval of the consultant selection and finalization of target commodities by the state. The second extension of 21 months up to 30 June 2021 was approved in March 2020 to allow time for (i) peer review and editing of the TA outputs, which were pre-feasibility studies for targeted value chain and market analysis; (ii) convening a publication launch workshop; (iii) undertaking financial analysis of potential investment projects, as requested by the Principal Secretary, Department of Agriculture, Government of Uttar Pradesh; and (iv) organizing an international study tour for government officials on market-oriented value chain development. The third extension of 4 months up to 31 October 2021 was approved in June 2021 to allow (i) fielding a final TA review mission to meet with the Department of Economic Affairs (DEA) and the state prior to finalizing the TA report and knowledge product; and (ii) publishing the final report as a knowledge product, both in English and Hindi. The second and third extensions were required since the government departments could not function at full capacity due to the impacts of the coronavirus disease (COVID-19) pandemic.

The TA was financially closed on 10 December 2021, with a cumulative disbursement of \$156,704.34 (70% of the allocated \$225,000). The government provided in-kind support for facilitation of the coordination and review meetings.

Conduct of Activities

Output 1. Market trends for five commodities analyzed. This output was achieved. The TA consulted the following key stakeholders from the state government: the Principal Secretary, Agriculture; Chief Economic Advisor to the Chief Minister; UPSAMB, and nodal officers of primary sector departments. A comparative assessment of 21 crops from six subsectors (excluding dairy and animal husbandry) was undertaken for the selection of the final focus crops. The assessment considered six parameters⁴ and two main drivers: (i) to create optimum impact for farmers, and (ii) to attract suitable investment along the value chain of the state. After due consultations, the state recommended five focus crops: potato, mango, guava, gram, and mustard, for which the TA undertook market trend analysis.

Output 2. Pre-feasibility study of targeted value chain completed. This output was achieved. The TA analyzed the value chains of the five crops selected under output 1. The major production clusters of each crop were identified, and field visits were conducted to selected clusters for each crop. Interviews and focus group discussions were conducted with representatives of the concerned departments from the state, and key stakeholders including farmers, farmer producer organizations (FPOs), value chain actors such as traders and commission agents, transport logistics providers, cold storage and post-harvest infrastructure operators, food processors, and the officials of the agriculture produce markets. The field visits and interviews were undertaken from May to July 2019. The assessments mapped the existing supply chains and identified gaps and inefficiencies at each stage.

The TA studied the institutional arrangements and infrastructure for each crop, which included its marketing infrastructure, existing technology in use, and the potential to introduce appropriate and better technology. The findings were presented to the Principal Secretary for Agriculture and the interdepartmental committee during the TA review mission in February 2020. The state government requested that the TA strengthen its market player analysis by identifying key private market players and analyzing their needs in terms of production standards and quality,

⁴ Six parameters were used: (i) percentage share in all-India production of the crop, (ii) area under cultivation in Uttar Pradesh, (iii) percentage share in agriculture and allied sector gross value-added, (iv) wastages along the value chain, (v) scope for value addition, and (vi) price volatility.

transportation facilities, and their coordination with the operations of the state-owned markets.⁵ It was also agreed that a Hindi version of the report be prepared so that the TA findings would reach a wider audience.

Subsequently, the TA interviewed 115 private sector actors and more than 50 firms and assessed the international and domestic markets for fresh and processed produce for the five selected commodities, as inputs for developing marketing strategies. Common suggestions for marketing strategies relate to (i) support for enterprise management and operation handholding of FPOs, (ii) development of market intelligence and price discovery mechanism, (iii) development of effective market linkage of FPOs with agribusinesses, (iv) branding of FPOs and their produce, (v) dissemination of quality standards, and (vi) creation of key post-harvest and processing infrastructure. On 8 October 2020, the revised draft report of the value chain analysis was presented to the state's Additional Chief Secretary, Agriculture and UPSAMB. The final report was approved by the state government and published in November 2021.

The TA also carried out parallel consultations with private agribusiness actors operating in the focus crop value chains and with those with potential for participation in improved value chains.⁶ The objective was to identify and assess the gaps constraining their growth and development and their willingness to engage with FPOs as buyers and co-investors, and to seek their suggestions for bridging these gaps.

Output 3. Stakeholder capacity on market-oriented value chain development strengthened. This output was canceled due to the prolonged impact of COVID-19. Initially, the TA planned for officials from UPSAMB and relevant departments to visit good examples of agriculture market systems in Maharashtra, Thailand, and Australia. However, on 9 October 2020 the state government and ADB agreed to cancel these study trips due to COVID-19 (footnote 5). During this period, agriculture departments across the country were engaged with the urgent task of supporting the functioning of agriculture markets and other farmer support activities, which made it difficult to organize virtual knowledge sharing events.

The publication of the knowledge product "Improving Agricultural Value Chains in Uttar Pradesh" helped in wider reach with other stakeholders, similar state governments, and other donor entities.⁷ The TA recommended that policy and institutional strengthening, along with investments, are necessary for (i) promoting and strengthening farmer collectives and aggregating smallholder farmers; (ii) strengthening market intelligence and price discovery mechanisms; (iii) improving access to finance through term loan, working capital and credit guarantees; and (iv) providing incentives to the agribusiness sector that promote long-term partnerships with farmers by supporting the procurement of large-scale purchases of quality products at farm level. A brief of the study's findings and recommendations is in Appendix 3.

Technical Assistance Assessment Ratings

Criterion	Assessment	Rating
Relevance	<p>The TA was aligned with the state's Agriculture Policy 2013 (footnote 2), and the Government of India's commitment to doubling farmer incomes by 2022.⁸ The TA was also consistent with ADB's country partnership strategy for India, 2018–2022, in supporting the diversification of agriculture production and development of value chains by forming farmers' cooperatives and motivating the private sector to invest in agribusiness and value chain networks.⁹</p> <p>The design and results chain were appropriate. The TA's rationale to support agricultural value chain development was justified and in line with the government's aim to grow the agriculture sector and encourage private sector participation. The use of the knowledge and support TA modality was appropriate in assisting the state with developing and applying a new</p>	<i>Relevant</i>

⁵ A minor change in implementation arrangement was approved on 22 February 2021 for undertaking the market player analysis. This came as a result of ADB and the government's decision on 9 October 2020 to cancel output 3 (workshops and study trips) due to the coronavirus disease (COVID-19) pandemic and reallocate resources towards output 2. The minor change also included additional translation services for the knowledge product from English to Hindi.

⁶ The TA prepared a database of 115 private sector agribusiness firms that included input suppliers; research and development agencies; technology providers; service providers in transportation, storage, packing, cold chains, and logistics; agro-cluster projects; agro and food companies and processors; mega food park projects; trading companies; exporters; organized retailers; and e-marketplaces.

⁷ ADB. 2021. [Improving Agricultural Value Chains in Uttar Pradesh](#). Manila.

⁸ Government of India, National Institution for Transforming India (NITI Aayog). 2017. [Doubling Farmers' Income: Rationale, Strategy, Prospects and Action Plan](#). Delhi.

⁹ ADB. 2017. [Country Partnership Strategy: India, 2018–2022—Accelerating Inclusive Economic Transformation](#). Manila.

Criterion	Assessment	Rating
	<p>framework for planning investments to improve agricultural value chains. This approach can be used by the state for various commodities.</p> <p>There were no major deficiencies during implementation except for the unanticipated COVID-19 impact that resulted in the cancellation of output 3. ADB and the state government undertook timely changes to address this issue. ADB was responsive to the government's request to accommodate additional study elements and translation of the final publication in Hindi. Overall, the TA is rated <i>relevant</i>.</p>	
Effectiveness	<p>The outcome was achieved as demonstrated by the state's endorsement of the TA's outputs and the knowledge product. The state's endorsement of the knowledge product and its translation to Hindi expanded the TA's reach and impact. The publication is now a reference by the state, ADB, and other sectoral development partners. Its findings are also applicable to other states with similar geographies and crops.</p> <p>The TA was able to establish and demonstrate a successful and replicable framework for future similar studies. Examples of good practices developed under the TA include: (i) conducting a larger primary sector analysis first and developing a framework for assessing various subsector crops—this helped with creating a reliable approach for selection of focus crops; (ii) undertaking detailed field studies and inclusive stakeholder consultations, which allowed comprehensive analysis of the value chains including estimation of production costs, market opportunities, and (iii) identifying gaps in policy and infrastructure. Although output 3 activities were dropped due to COVID-19, the TA responded quickly to reallocate funds and direct attention to improving output 2 achievements. The improvements made further strengthened the linkages with private sector entities and helped in the development of the knowledge publication.</p> <p>The outcome was achieved through the active support and participation of the state government and ADB throughout the TA implementation period. The TA was able to produce high-quality technical analysis of value chains of selected commodities—the findings and recommendations of which are now being utilized in discussions for new agricultural value chain projects not only by the state but also in other states in India. For these reasons, the TA is rated <i>effective</i>.</p>	<i>Effective</i>
Efficiency	<p>The TA's outcome was achieved by utilizing only 70% of the original budget. The outcome was achieved even though the planned training and workshops were not conducted due to COVID-19 related restrictions. This resulted to 24% of the total TA budget (\$55,000 of \$225,000) allocated to training and workshops remaining unspent. To maximize the contribution of the TA, ADB and the government agreed to allocate additional resources on the production of the knowledge publication and local language translation which account for the increase in miscellaneous administration usage. The TA also reallocated resources towards additional private market player analysis which further strengthened the linkages with private sector entities.</p> <p>While the implementation experienced delays of 25 months, these were largely due to two extenuating factors: (i) the impacts from the COVID-19 situation and restrictions, and (ii) the additional time required to convert the TA findings into a knowledge product—this delay was mainly related to government approval processes and did not affect the cost of delivery of the outputs.</p> <p>The TA had indirect socioeconomic benefits. The knowledge product of the TA has been useful in discussions for new agricultural value chain projects in other states in India. Also, a new investment proposal discussion has been</p>	<i>Efficient</i>

Criterion	Assessment	Rating
	initiated with the state for overall agriculture productivity improvement in the state. Taking all these into consideration, the TA is rated <i>efficient</i> .	
Overall Assessment	The TA developed an approach for agricultural value chain studies with the inclusion of comprehensive cost and income analysis for farmers, along with the global market analysis, infrastructure, and institutional gaps. The TA's rationale was clearly explained, and the TA modality was appropriate. Accommodating the client's requests and expectations, such as strengthening the market player analysis and publishing the knowledge product, were readily and adequately addressed. The outcome was achieved with the publication of a knowledge product in English and preparation of the Hindi version. The TA's approach can be replicated and upscaled to support other ADB-supported value chain project designs. The outputs were achieved within budget. Thus, the TA is rated <i>successful</i> .	<i>Successful</i>
Sustainability	<p>The TA is rated <i>likely sustainable</i>. The recommendations of the TA are aligned with and further strengthen the state's ongoing initiatives towards the implementation of the Agriculture Policy 2013 (footnote 2). The TA provided recommendations for (i) improving the efficiency of existing institutions and infrastructure from the perspective of crop production and post-harvest improvements, (ii) promoting FPOs, (iii) enhancing the agribusiness sector, and (iv) overall development of agricultural value chains in Uttar Pradesh. The TA also developed a practical framework for improving the state's agricultural value chain for five commodities and this approach can be used by the state for other commodities.</p> <p>In parallel, the state is moving ahead with improving the sector by (i) amending the Uttar Pradesh Krishi Utpadan Mandi Ordinance to remove 46 fruits and vegetables from the purview of the Act to allow free trade of these commodities in the state; (ii) initiating the Atmanirbhar Kisan Integrated Development Scheme to support FPO development at the block level; (iii) supporting the One District One Product scheme to promote unique handicrafts, agro-processed products, and other specialized products of each district;¹⁰ (iv) initiating the Uttar Pradesh Agriculture Export Policy 2019 to foster agricultural exports and double the income of farmers;¹¹ and (v) promoting private sector investment in the food processing sector through implementation of the Uttar Pradesh Food Processing Industry Policy 2017.¹²</p>	<i>Likely sustainable</i>

Lessons Learned and Recommendations

Design and/or planning	<p>The client's expectations on what can be achieved under a small-scale TA design must be well articulated and understood during design and implementation. During implementation, the government wanted the TA's scope to be expanded to include the preparation of preliminary detailed designs, which would have required a larger budget and would be more appropriately financed under a transaction TA or project readiness financing.</p> <p>Also, projects that include preparation and publication of knowledge products should accurately assess the implementation schedule for undertaking the knowledge work, since it requires significant time and interaction with stakeholders to ensure ownership and additional time for obtaining government clearances.</p>
Implementation and/or delivery	For projects with similar studies involving different subsectors across multiple government departments, it should be coordinated at an apex level entity, to ensure faster identification of follow-on investments based on the recommendations of the study. UPSAMB was an effective and supportive executing agency for the TA, however the involvement of the state's agriculture and horticulture directorates could have further benefitted the TA's implementation and outputs as they deal more closely with the focus crops.

¹⁰ One District One Product. <http://odopup.in/>.

¹¹ Government of Uttar Pradesh, Department of Agriculture Marketing and Agriculture Foreign Trade. 2019. [Uttar Pradesh Agriculture Export Policy 2019](#). Lucknow.

¹² Government of Uttar Pradesh, Department of Horticulture and Food Processing. 2017. [Food Processing Industry Policy 2017](#). Lucknow.

Knowledge building	COVID-19 affected large scale virtual or physical knowledge sharing events but moving forward the state can continue to update these value chain studies and add more value chain studies for other focus commodities under a similar framework. ADB has hosted the knowledge publication on its website and the state will host the Hindi and English versions on their website for improving outreach within the state.
Stakeholder participation	Ensuring participation of stakeholders on issues involving multiple interests leads to better project outcome. The TA undertook many stakeholder engagements with relevant government departments, farmers, existing FPOs, and the private sector to understand the existing value chain model, their needs, and where infrastructure gaps may exist and how they can be addressed by the state. These consultations happened throughout the TA implementation and their guidance helped shape the TA's outputs. This approach led to the successful outcome of the TA and its recommendation that wide, and continual consultations with both government and private stakeholders should be undertaken in similar future projects.
Partnership	Quality knowledge products can influence global dialogue and catalyze financing from the development community. Findings from the knowledge product opened up opportunities for engagement with other development partners and provided possible entry points for ADB's participation in the future. Currently, the state is mobilizing technical assistance resources from other organizations like the Bill and Melinda Gates Foundation, and the Water Resources Group of the World Bank to improve the utilization of the state government's budgetary allocation for agriculture. Meanwhile, ADB is in discussion with the state on developing an investment project to improve agriculture production (discussed in more detail below).
Replication and/or scaling up	The value chain study framework developed under this study can be replicated for similar projects that require identification of potential agribusiness investments in similar geographies. The study can be widely shared with other states in India and other South Asia developing member countries (DMCs). The value chain analysis considered all the steps and costs from production to retail market for each focus commodity. The assessment of activities and profit margin at each step of the value chain would help in understanding the pathways and investments needed to improve farmers' incomes.
Post-TA financial resources	ADB's continuous engagement with the government is crucial for improving the state's overall agricultural production and productivity. Following the study, ADB is in discussion with the state on developing an investment project to address the regional productivity variation, lack of extension services and market linked agriculture production. Necessary TA support shall be mobilized to support the project due diligence after formal receipt of proposal through the DEA.

Follow-up Actions

The TA published the English version of the knowledge product, "Improving Agricultural Value Chains in Uttar Pradesh", in November 2021. The Hindi version was prepared and will be printed if requested by the state government. The project team will monitor its publication and circulation.

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DESIGN AND MONITORING FRAMEWORK

Impact Agricultural value chains of high value crops in Uttar Pradesh strengthened. ^a		
Results Chain	Performance Indicators with Targets and Baselines	Achievements
Outcome Recommendations for improved agricultural value chains in Uttar Pradesh prepared	a. Recommendations presented to ADB and the government	a. Achieved. The TA's final report was accepted by the Government of Uttar Pradesh and published as a knowledge product titled "Improving Agricultural Value Chains in Uttar Pradesh" in November 2021.
Outputs 1. Market trends for five commodities analyzed 2. Pre-feasibility study of targeted value chain completed 3. Stakeholder capacity on market-oriented value chain development strengthened	1a. Market analysis for oil seeds, pulses, potato, mango, and guava completed (2018 baseline: NA) 1b. Preliminary marketing strategies on at least two commodities completed (2018 baseline: NA) 2a. Analysis addressing gaps and opportunities of value chain development for five commodities (oil seeds, pulses, potato, mango, and guava) completed (2018 baseline: NA) 3a. At least two knowledge workshops organized (2018 baseline: NA) 3b. At least one study tour organized (2018 baseline: NA)	1a. Achieved. The TA initially analyzed 21 primary sector commodities. Based on multi-criteria analysis, the government recommended five focus commodities (gram, mustard, potato, mango, and guava) for further market analysis. 1b. Exceeded. Marketing strategies were undertaken for 5 selected focus commodities. 2a. Achieved. Detailed value chain analysis was completed and presented to the state government. The report was further updated to address the state government's request to strengthen market player analysis by identifying key private market players and analyzing their needs. The final report was approved by the state government and published in November 2021. 3a. Not achieved. This output was canceled due to prolonged impact of COVID-19. 3b. Not achieved. This output was canceled due to prolonged impact of COVID-19.
Actual Key Activities with Milestones 1. Market trends for five commodities analyzed 1.1. ADB recruited and mobilized consultants in January 2019. 1.2. Conducted gap analysis and emerging challenges in marketing five commodities (oil seeds, pulses, potato, mango and guava), and prepared market research paper. Report presented to the government in March 2019. 1.3. Prepared preliminary marketing strategies on global and domestic market demands of at least two commodities. Report presented to the government in March 2019. 2. Pre-feasibility study of targeted value chain completed 2.1. ADB recruited and mobilized consultants in January 2019. 2.2. Assessed institutional organization and knowledge capacity of market-oriented value chain development and developed capacity building program. Report presented to the government in March 2019. 2.3. Reviewed existing agriculture-related market development, value chain, trade studies and plans. Report presented to the government in March 2019. 2.4. Conducted gap analysis in infrastructure, governance, networking, and knowledge. Draft report presented to the government in February 2020.		

2.5. Conducted preliminary costing of the proposed value chain investments. Draft report presented to the government in February 2020.

2.6. Final report of pre-feasibility study on targeted value chain presented to the government in October 2020.

3. Stakeholder capacity on market-oriented value chain development strengthened

3.1. Conduct of knowledge workshops on agricultural innovation and market development was cancelled due the COVID-19 pandemic.

3.2. Conduct of study tours on market-oriented value chain development was cancelled due to the COVID-19 pandemic.

Actual Inputs

Asian Development Bank: \$156,704.34

The government provided in-kind support for facilitation of the coordination and review meetings.

ADB = Asian Development Bank, COVID-19 = coronavirus disease, NA = not applicable, TA = technical assistance.

^a Government of Uttar Pradesh. 2013. [*Uttar Pradesh Agriculture Policy 2013: Roadmap for Progress and Prosperity*](#). Lucknow. The TA supports the Government of Uttar Pradesh's aim to increase the income of farmers through agricultural diversification towards high value activities.

Source: Asian Development Bank.

TECHNICAL ASSISTANCE COST

Table A2.1: Technical Assistance Cost by Activity
(\$'000)

Item	Amount		
	Original ^a	Revised ^b	Actual
1. Consultants	161.0	161.0	150.7
2. Training, seminars and/or conferences	55.0	55.0	0.0
3. Miscellaneous TA administration	0.0	2.5	6.0
4. Contingency	6.5	6.5	0.0
Total	225.0	225.0	156.7

^a. Original estimated cost in the TA report.

^b. Based on minor change in implementation approved in February 2021.

Source: Asian Development Bank estimates.

Table A2.2: Technical Assistance Cost by Fund
(\$'000)

	TASF - Other Sources	Total Cost
1. Original ^a	225.00	225.00
2. Actual	156.70	156.70
3. Unused	68.30	68.30

TASF = Technical Assistance Special Fund

^a Original estimated cost in the TA report.

Source: Asian Development Bank estimates.

BRIEF OF STUDY FINDINGS AND RECOMMENDATIONS

A. Major Challenges

1. **Potato.** The challenges are: (i) low productivity due to reduced groundwater availability; (ii) injudicious use of inputs; (iii) low scale of operations; (iv) lack of proper sorting, grading, and packing of produce leading to higher wastage and expenses; (v) technically outdated single-product cold storage; (vi) lack of organized potato processing firms in the state owing to low volumes of processable varieties; (vii) lack of real-time market and price information; and (viii) limited access to affordable finance by farmers engaged in the potato value chain.

2. **Mango.** The challenges are: (i) old and senile orchards; (ii) lack of quality planting materials; (iii) injudicious use of chemical inputs leading to declining productivity; (iv) poor harvesting techniques resulting in about 10%–15% wastages owing to fruit bruising and cracking; (v) lack of primary processing e.g., manual sorting and grading and use of ineffective packaging materials leading to low price realization; (vi) lack of packhouses, cold storage, and refrigerated logistics which restricts access to distant markets and increases wastage; and (vii) domination of farmers' sales by contractors and commission agents which limits farmers' bargaining power.

3. **Guava.** The challenges are: (i) lack of availability of quality planting materials; (ii) lack of awareness and availability of nonchemical plant protection kits and bioagents; (iii) inappropriate primary processing practices; (iv) lack of packhouses and common collection centers; (v) lack of availability of cold storage spaces for guava; (vi) poor condition of farm access roads and lack of appropriate transportation facilities; and (vii) low level of processing.

4. **Gram.** The challenges are: (i) higher seed rate and use of seed from previous crops which reduces productivity; (ii) inappropriate fertilizer use, plant protection, and intercultural operations and irrigation; (iii) limited arrangements in market yards for scientific weighing and quality testing which widens the scope for malpractice.

5. **Mustard.** The challenges are: (i) lack of awareness on best cultivation practices; (ii) weak market infrastructure in the mandi particularly for weighing and quality assessment; (iii) delays in procurement and payment settlement; (iv) lack of knowledge on seed sale prices; and (v) farmers tend to depend more on informal sources of financing such as local money lenders, who charge higher interest rates, as they face difficulties obtaining institutional credit for cultivation purposes.

B. Potential Interventions

6. **Potato.** The potential interventions are: (i) establishment of standardized tissue culture and micro-propagation techniques; (ii) setting up of small-scale potato processing units and larger scale processing units for manufacturing other value-added products; (iii) creation of near-to-farm-gate; and (iv) shift to energy-efficient and modern cold storage facilities.

7. **Mango.** The potential interventions are: (i) rejuvenation of the large number of old and senile mango orchards; (ii) setting-up of public and private hi-tech, multi-crop nurseries to supply quality rootstock to farmers; (iii) uniform handling and aggregated marketing of produce; (iv) provision of high-end facilities, such as vapor heat treatment and irradiation facilities to augment the existing infrastructure and capacity for export; and (v) establishment of model Individual Quick Freezing (IQF) and canning units to encourage processing of table variety mango.

8. **Guava.** The potential interventions are: (i) establishment of public and private hi-tech nurseries producing disease-free planting material to set up and maintain healthy orchards; (ii) promotion of drip irrigation systems in guava orchards; (iii) setting-up of modern packing houses to increase marketability and access to distant markets; and (iv) setting-up of integrated facilities for pulping and juicing.

9. **Gram.** The potential interventions are: (i) appropriate storage structures both on farm and in the market; and (ii) value addition into gram processing.

10. **Mustard.** A potential intervention would be to strengthen quality testing infrastructure in major markets, such as equipping them with cleaning and grading machines, moisture meters, and oil content analyzers to ensure fair and transparent price setting.

C. Common Areas of Investment in Agricultural Value Chain Development for the Focus Crop Value Chains

11. There are several areas for investments for the focus crop value chains:

- (i) Encouraging and supporting farmers to adopt better cultivation practices and to improve their knowledge of quality requirements and standards, harvesting and post-harvest techniques, with potentially significant impacts on productivity and their marketable surplus.
- (ii) Promoting and strengthening farmer collectives associated with crop-growers for aggregated sales and marketing produce as well as dissemination of advanced technologies among producer members; interventions are also required to improve market links between growers and private sector players within and outside the state, particularly processors.
- (iii) Strengthening market intelligence and price discovery mechanisms to provide real-time information on arrivals and grade-specific pricing at different markets within and outside the state.
- (iv) Extending term loans and working capital loans, with partial loan guarantees for farmer collectives and agro-enterprises, to help reduce growers' dependence on cold storage owners and other informal sources and encourage more farmers to engage in collective production and marketing.
- (v) Encouraging the use of various web- and app-based models of agriculture market information systems among farmers and farmer collectives for access to real-time market intelligence, especially grade-specific pricing, and transparent price discovery.
- (vi) Training and capacity-building for farmers, farmer collectives, traders, and intermediaries to improve their understanding and knowledge of trading parameters and standards related to quality, produce grading, and pricing. Promoting farm mechanization suitable for smallholder cultivation by establishing multi-crop equipment banks across different blocks.
- (vii) Assisting farmer producer organizations in setting up retail outlets near urban markets.
- (viii) Creating of dry storage infrastructure to cater to the needs of smallholder farmers for storage of their produce.

D. Private Sector Assessment and Opportunities for Co-investment

12. The following suggestions are based on interviews with 115 private sector actors and detailed discussions with more than 50 firms: (i) promotion and capacity building for farmers and FPOs, (ii) maintaining farmer's access to agro-inputs, (iii) provision of crop advisory services and training on improved production practices, (iv) harvesting and postharvest management, (v) development of post-harvest infrastructure and storage facilities, and (vi) provision of financial support and incentives. The study also suggests links to recent reforms in agricultural sector development by summarizing three acts of the Government of India: (i) The Essential Commodities (Amendment) Act, 2020; (ii) The Farmers' Produce Trade and Commerce (Promotion and Facilitation) Act, 2020; and (iii) The Farmers (Empowerment and Protection) Agreement on Price Assurance and Farm Services Act, 2020. The Government of India repealed the three new farm laws in December 2021.

E. Recommendations for Institutional Development and Infrastructure Enhancement

13. The study identifies areas of intervention for institutional development and infrastructure enhancement from the perspective of production and post-harvest improvement, farmer collective promotion, agribusiness sector enhancement, and overall development of agricultural value chains. This

analysis suggests that Uttar Pradesh could invest in (i) training farmers on best practices in cultivation and postharvest management, (ii) strengthening farmer collectiveness by assisting farmer producer organizations (FPOs) in hiring professional staff to manage business operations and build market links, (iii) improving market intelligence and transparent price discovery mechanisms, (iv) providing incentives to the agribusiness sector that promote long-term partnership with farmers by supporting the procurement of large-scale purchases of quality products at farm level, and (v) enhancing guarantee scheme coverage.