



**Australian Government**

**Australian Centre for  
International Agricultural Research**

# Final report

*Project full title*

**Strengthening vegetable value chains in Pakistan for greater community livelihood benefits**

*project ID*

HORT/2016/012

*date published*

2/08/2023

*prepared by*

Dr. Babar Ehsan Bajwa, Mr. Muhammad Asif, Dr. Tim Sun and Dr. Gomathy Palaniappan

*co-authors/  
contributors/  
collaborators*

Dr. Habat Ullah Asad, Mr. Azeem Hayder Naqvi, Dr. Rehan Riaz, Dr. Hafiz Mahmood ur Rehman, Mr. Qadeer Ahmad, Dr. Tony Dunne and Dr. Ray Collins

*approved by*

Ms Irene Kernot, Research Program Manager, Horticulture

*final report number*

FR2023-039

*ISBN*

978-1-922983-44-2

*published by*

ACIAR  
GPO Box 1571  
Canberra ACT 2601  
Australia

This publication is published by ACIAR ABN 34 864 955 427. Care is taken to ensure the accuracy of the information contained in this publication. However ACIAR cannot accept responsibility for the accuracy or completeness of the information or opinions contained in the publication. You should make your own enquiries before making decisions concerning your interests.

© Australian Centre for International Agricultural Research (ACIAR) 2023 - This work is copyright. Apart from any use as permitted under the *Copyright Act 1968*, no part may be reproduced by any process without prior written permission from ACIAR, GPO Box 1571, Canberra ACT 2601, Australia, [aciarc@aciarc.gov.au](mailto:aciarc@aciarc.gov.au).

## Contents

<b>1</b>	<b>Acknowledgments</b> .....	<b>3</b>
<b>2</b>	<b>Executive summary</b> .....	<b>4</b>
<b>3</b>	<b>Background</b> .....	<b>6</b>
<b>4</b>	<b>Objectives</b> .....	<b>7</b>
<b>5</b>	<b>Methodology</b> .....	<b>8</b>
<b>6</b>	<b>Achievements against activities and outputs/milestones</b> .....	<b>11</b>
<b>7</b>	<b>Key results and discussion</b> .....	<b>37</b>
<b>8</b>	<b>Impacts</b> .....	<b>47</b>
8.1	Scientific impacts – now and in 5 years .....	47
8.2	Capacity impacts – now and in 5 years .....	47
8.3	Community impacts – now and in 5 years .....	48
	8.3.1 <i>Economic impacts</i> .....	48
	8.3.2 <i>Social impacts</i> .....	49
	8.3.3 <i>Environmental impacts</i> .....	49
8.4	Communication and dissemination activities .....	49
<b>9</b>	<b>Conclusions and recommendations</b> .....	<b>51</b>
9.1	Conclusions.....	51
9.2	Recommendations .....	51
<b>10</b>	<b>References</b> .....	<b>53</b>
10.1	References cited in report.....	53
10.2	List of publications produced by project.....	53
<b>11</b>	<b>Appendixes</b> .....	<b>59</b>
11.1	Appendix (Annual reports) .....	59

---

# 1 Acknowledgments

This report depicts the contribution and collaboration of various government and national agriculture sectors, researchers and local NGOs regarding their work with farmers community to uplift their livelihood in Pakistan from February 2018- December 2022. The achievement and success yet were not even conceivable without the input and feedback of the worthy partners in the selected project sites, those were actively engaged in identifying livelihood problems, reviewing and testing solutions in all the field activities from production to marketing for sustainable vegetable value chain development.

With the passage of time, the partners' relations became strong and influential in creating production and marketing opportunities, as well as developing strong relations with market actors of Punjab and Sindh. Moreover, the engagement of extension officers for scaling out and the capacity building of extension department of agriculture extension wing teams of Punjab and Sindh remained beneficial for value chain project sustainability.

The project was the contribution of hundreds of people directly and indirectly including researchers, farmers, traders and extension workers. While it is not possible to mention all of them to show the gratitude for their engagement, the core members of the project research team from CABI Regional Bioscience Center Pakistan: Dr Babar Ehsan Bajwa, Mr Muhammad Asif, Dr Habat Ullah Asad, Dr Hafiz Mahmood Ur Rehman, Dr Rehan Riaz, Mr Azeem Naqvi and Mr Qadeer Ahmad,

University of Queensland: Dr Gomathy Palaniappan, Prof Ray Collins, Dr Tony Dunne, Dr. Ximing Sun,

University of Agriculture Faisalabad: Professor Aman Ullah Malik (Postharvest Expert), Dr Khurram Ziaf (Production Horticulture Expert), Dr Raheel Anwar (Postharvest Expert)

Engro Foundation: Mr Awais Amar Mahar, Ms Shafaq Javed

Pakistan Agricultural Research Council: Dr Muhammad Zubair, Dr Sajida Taj

Punjab Agriculture Extension Wing: Mr Abdul Razzaq

Sindh Agriculture Extension Wing: Mr. Mir Hajan Talpur

Sindh Agriculture University, Tandojam: Dr. Aasia Panhwar

We pay an acknowledgment to ACIAR staff for their support in respect of technically, financially and conceptually as well as morally.

---

## 2 Executive summary

The project aimed to enhance the sustainable livelihoods of small farmers in rural vegetable communities in Punjab and Sindh in Pakistan by utilizing a combination of value chain theory, participatory approaches, and whole family approaches. The research strategy employed in this project has proven to be highly effective and successful. By providing participatory training to farmers on walking the chain activities, conducting consignments, setting up intervention trials, and adopting value chain interventions, the project has incentivized farmers to shift their attitudes and behaviours from being primarily production-led to being more market-oriented. Farmers have become more attentive to improving the quality of their crops to meet market demands, resulting in better prices for their produce and decreased waste. The project has also achieved greater engagement with women and youth through a whole-family approach that sensitized men to support women and youth to participate in value chain activities.

In the onion value chain, the main quality issues in the market are short shelf life and mixed quality in bags. Four interventions were introduced to farmers for mitigating these problems 1) Stopping irrigation 20 days before harvesting, 2) Curing for 2 weeks after harvesting, 3) Proper cutting, sorting and grading and 4) More direct marketing.

The onion village, Ibrahim in Sindh, has a total of 250 households and among them, 201 grew onions in the 2021-2022 season. The project team conducted individual surveys of 196 farmers growing onions and more than 98% of them adopted the interventions. The average volume produced from each onion farmer adopting the interventions was 26.5 tonnes. The total volume of intervention onions produced from this village was 5,140 tonnes and most of them were exported. The average local market price in the 2021-2022 season was PKR 485/40 kg and the average price the village farmers received from their intervention onion was PKR 812/40 kg, 67% more than the average local market price. In addition, onion Labourers including men and women were paid PKR20 extra per bag of 40 kg onions due to extra skilled work to implement postharvest interventions.

The tomato flagship initiative (TFI) team established a foundation farmers group consisting of 5 male-led farmers families and 2 female-led farmers' families in village Baili Janobi, while apprentice and new apprentice farmers' groups were formed in two other villages, Haji Wah and Jagat Pur, in district Muzaffargarh. The team worked with these farmers to build their capacity in production, postharvest, marketing and social skills. By the 2022 season these numbers had reached 24 farmers' families. For the third successive season, the project has been able to demonstrate to smallholder farmers the advantages of adopting nursery seedling production 'best practice', including the use of standardization of local growing media and plug trays which are considered innovative by local farmers. The data analysis shows that "best practice" has more than 90% germination, healthy seedlings and low average cost when compared to traditional seedling production practices. In addition, the sale of nursery 'best practice' seedlings by both male and female TFI farmers has demonstrated that the raising of seedlings in a nursery tunnel can also be a profitable business opportunity for female family members. Four women worked with nine men collectively to grow the tomato nursery. They sold 19,000 seedlings in 2021-2022, which increased household income by PKR 15,200 in total. A total of 15 tomato farmers have adopted the SVVCP tomato 'best practice'. Financial data analysis in 2021-22 season showed that across all the TFI farmers 1) the average gross margin was PKR 242,676 (86%) per acre higher than that of the benchmark traditional farmers, 2) the average price per kilogram was PKR 11 (30%) higher than that of the benchmark traditional farmers and 3) the cost of production was 16% low than that of the benchmark traditional farmers.

In the potato value chain, the main issues facing local customers were potato scab, small size and mixed quality in bags. Four interventions were developed around these issues and introduced to farmers, including 1) seed sorting and fungicide treatment, 2) split fertilizer use, 3) sorting and grading after harvesting and 4) collective marketing. These interventions were

proven effective. In potato villages 38D and 37D, 10 farmers delivered 14 consignments (150 tonnes) during the project lifetime. Financial data showed that they increased their revenues by 56% on average as compared with conventional farmers. A survey for general adoption in the two villages was conducted with 77 farmers who cultivated potatoes in 2022. Results showed 80% of farmers adopted pre-sowing seed sorting and treatment, 85% of farmers adopted postharvest sorting and grading and 70% of farmers adopted collective marketing. The total SVVCP potato production from the two villages was 2,591 Tons, 43 tons/per farmer on average. The average local market price in the 2021-2022 season was PKR 1464/110 kg and the average price the village farmers received from their intervention was PKR 1738/110 kg, 18% increase compared to the average local market price. The net profit of each farmer was PKR 91,998 on average.

A small rural enterprise (SRE) for value addition was established by the project in village Loung Khan Soomro in Sindh to produce green chili chutney, onion pickle and mix pickle and chili chutney. After improving quality and reducing cost through the first two business cycle trials, two adults from one family of five marketed their products by supplying to local retailers and wholesalers. Over the next twelve months their business showed a steady and sustainable increase in profitability, with a turnover of PKR 57,850 for a net profit of PKR 18,687. Although based on just one family's efforts, these results indicate that there may be potential for viable family-based small-scale enterprises producing value-added vegetable products, but this requires further research.

Another significant outcome of the project was the identification of opportunities for increased engagement of women and youth in value chains and farm production. Responsiveness to the needs of women and girls was a fundamental part of this project. Through baseline surveys of the target villages, the needs of women, the cultural and social norm as well as restrictions regarding female activities were understood. Based on this understanding, and value chain interventions introduced, the engagement activities for women and youth in the value chain were designed. The whole family approach supported by field female social mobilizers have successfully enabled these engagement activities. Final survey of women indicated significant social and economic improvement of their life.

Throughout project life, the project team trained 343 direct beneficiaries vegetable farmers (172 men, 135 women and 36 youth) and 1166 indirect beneficiary farmers (779 men, 291 women and 96 youth) across the three vegetable value chains in the areas of nursery production, crop management, postharvest, marketing and community engagement. Moreover, 67 personnel from all project partners, including 45 men and 22 women, participated in project activities.

In summary, a major outcome of this project was the development of a Value Chain Approach/Whole Family Extension Approach/Participatory Action Research model that was used to identify value chain constraints and develop interventions to increase product quality and production efficiency resulting in significant increase in household income and crop gross margins per acre. The strength of this model is sustainable of the demonstration value chains due to its treatment of the whole value chain as a system and creating a win-win situation for all chain members. The weakness is the requirement of a multidisciplinary research team for the implementation of this model. Forming such a research team is a challenge to most developing countries. There are three key lessons learned over the project life 1) Starting with a small number of farmers in the target villages who are aggressive and willing to change for the demonstration chain development rather than training many, 2) Conducting consignments to demonstrate the financial benefits of interventions to farmers is the key for driving adoption and 3) Frequent visiting farmers and communicating with them by research teams is indispensable for project success. This can only be possible, in most cases, by employing full time field officers and social mobilizers.

---

## 3 Background

The Agriculture Value Chain Collaborative Research program (AVCCR) (referred to as Aik-Saath in Urdu language), launched in 2016, is a partnership between ACIAR and DFAT. The program builds on the recent Australia-Pakistan Agriculture Sector Linkages Program (ASLP). The Australian Government is supporting this program for continued investment in Pakistan as a priority country, and it is in line with ACIAR's intended country outcome of improved smallholder profitability through value chain development. AVCCR's goal is that rural poor, particularly women, living in the Punjab and Sindh significantly and equitably benefit from improvements in strategic value chains, see [http://aciarc.gov.au/files/avccr\\_brief-program\\_web.pdf](http://aciarc.gov.au/files/avccr_brief-program_web.pdf) for a brief summary of the program.

Agriculture is the backbone of the economy of Pakistan. The Pakistan Government's 'Pakistan Vision 2025', acknowledges that agricultural performance has been poor, and that Government services, particularly research and extension, have been insufficiently responsive to farmers' needs. The Ministry of National Food Security and Research (MNFSR) has identified the performance of the research community in servicing the needs of a vibrant innovation-based agricultural sector, as an area for improvement. This highlights that while major innovations have been made in fruit, dairy and poultry value chains, fewer 'improvements have been made with other high value perishables, particularly vegetables and livestock'<sup>1</sup>.

The production and marketing of vegetables is an important component of rural industry in Pakistan and provides opportunities for improving economic wellbeing and nutritional status. Up to 9 million tonnes of vegetables are grown annually on around 630,000 ha, with Punjab and Sindh accounting for 70% and 13% of production, respectively. The target beneficiary groups of this project are the rural poor, particularly women and youth who are disadvantaged in participating effectively in existing vegetable value chains, owing to constraints that are many and complex. These constraints include: a lack of standardised production technologies; the absence of post-harvest handling infrastructure and protocols; a lack of awareness of marketing options; obstacles to financial support and technical and business knowledge; and a host of social and cultural barriers. Thus emerged the focus of this project (the sustainable development of more efficient and profitable vegetable value chains).

The project contributes to the Australian Aid priorities of (1) engaging with the private sector, (2) reducing poverty, and (3) empowering women and youth. It aligns directly with ACIAR's intended country outcome for Pakistan of improved smallholder profitability through value chain development. It delivered value for money by engaging with the most effective partners, with a proven track-record of collaborative *R4D* and of *delivering results at farm and community level*.

Various government and private organizations are involved in research on social aspects of the target value chains. Among them, CABI was invited as a commissioned organization to take lead in this value chain project due to its diverse experience of implementation of research and development projects in the agriculture sector, and more particularly for horticulture value chains in Pakistan.

---

<sup>1</sup> Government of Pakistan. 2018. National Food Security Policy. Ministry of National Food Security and Research, Islamabad. pp 10.

---

## 4 Objectives

This project contributes to the overarching development goal of the AVCCR program: *‘that rural poor, particularly women, living in the Punjab and Sindh significantly and equitably benefit from improvements in strategic value chains.* The ultimate **Impact** of the horticulture project would be *improved livelihoods of Pakistan rural communities through strengthened horticultural value chains, promoting sustainable production and market opportunities.*

The aim of this project was to strengthen the value chains of three vegetable crops in Pakistan using a community-based approach. The target crops were onions, potatoes, and tomatoes. By building the capacity of participants in these value chains, including farming families, traders, and intermediaries, the project sought to improve household income and livelihoods of resource-poor communities. The partnerships established in the project are expected to enable project outcomes to be scaled out after its conclusion.

To achieve the project aim, the project is structured around four principal objectives. The focus of each objective is on smallholder women, men and youth and associated communities in Sindh and Punjab:

**Objective 1** To identify opportunities for increasing community engagement and developing rural entrepreneurship.

**Objective 2** To establish sustainable production and marketing opportunities for small-scale vegetable farmers and traders.

**Objective 3** To test and develop technical innovations for selected vegetable value chains.

**Objective 4** To scale-out improvements in vegetable value chains, and sustain and maximise community benefits.

In order to effectively deliver these objectives, the project also undertook cost/benefit analyses to evaluate the effectiveness of the interventions introduced.

This project was designed as a horticultural project with a strong social research component. The following five research questions were framed around understanding how the manifold constraints affecting smallholder vegetable farmers could best be addressed by working with target beneficiary households from the start of the project.

1. What are the pro-poor vegetable chain opportunities that improved rural entrepreneurship and sustainable enterprises of target communities (particularly for the benefit of women and youth) in Pakistan? [relates primarily to Objective 1]
2. What are the challenges and opportunities experienced by small-scale vegetable farmers and traders, and associated communities, in tomatoes, potatoes and onions value chains in Punjab and Sindh? [relates primarily to Objective 2]
3. How can rural entrepreneurs identify, evaluate and adopt technical and social interventions to enhance production and marketing of tomatoes, potatoes and onions in Punjab and Sindh? [relates primarily to Objective 3]
4. What are the capacity building activities that can enable scale-out of selected value chain improvements in smallholders' led tomatoes, potatoes and onions chains in Pakistan and what other interventions are necessary to achieve maximum impact of these value chain interventions? [relates primarily to Objective 4]
5. To what extent is women's contribution to horticulture value chains recognized; what are the gender-related rights and denials that limit their participation, and how can these be addressed to improve community livelihoods? [crosscutting and relates to each objective and research question]

---

## 5 Methodology

Multiple research approaches were adopted to service the designed research objectives, including a value chain approach, participatory action research (PAR) and a whole family approach. The value chain approach focused on the pivotal role of consumer demand and the identification of leverage points where interventions could catalyze improved value chain efficiency and competitiveness. Understanding the functioning of the chain, including the linkages between the value chain participants, is key to ensuring that the project achieves its stated objectives. The whole family approach was adopted so that the research team can work not only with individual farmers but also with their family members both separately and together to ensure the engagement of women and youth. Participatory action research is the other indispensable element in this project, to ensure that the value chain and whole family approaches were more effectively applied. Two important aspects to the PAR approach were adopted: 1) the training needs assessment (TNA) surveys to identify training needs of the men and women farmers to improve their performance, (2) the involvement of the farmers and their families in designing the training content and timing of the training sessions. In this project, experiment trials which are normally located in agricultural research stations or universities were brought into farmers' fields in the villages, so that individual farmers as well as their family members could participate in all the research activities and observe the outcomes. The project also engaged farmers in "walking the chain" which provides farmers with the opportunity to observe and analyse the chain. Farmers could identify opportunities, evaluate the opportunities and make decisions on what interventions and innovations are needed and which ones are applicable from their perspectives.

The "Walk the Chain" activity was captured on video to address the barriers to women's participation in market-related decision-making.

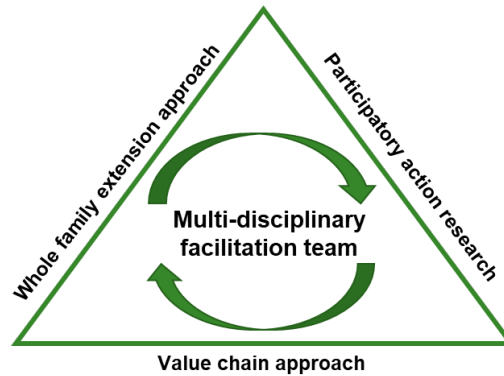
To ensure the successful application of the research approaches outlined above, multidisciplinary research teams were established. Traditionally, research teams working in different fields have focused on their own specific issues, resulting in interventions that have had limited overall impact. This more holistic approach addressed the challenges and opportunities in both the community and along the value chain.

Communities and value chains are both complex systems, and the problems within them often extend beyond the boundaries of any individual research field. As a result, a multidisciplinary team was formed for this project, involving various institutions in Pakistan and Australia. The social team played a critical role in identifying gender gaps and selecting and engaging communities, while the marketing team helped identify opportunities along the value chain. The production and postharvest teams, along with food technicians, contributed to the development of intervention technologies that were suitable for the local community.

Overall, the formation of a multidisciplinary team was essential in ensuring the success of this project, as it enabled a more comprehensive and integrated approach to addressing the challenges and opportunities within the community and along the value chain.

The multidisciplinary approach brought the value chain and community into one integrated study object as shown in Fig 1.





*Fig 1: SVVCP Project approaches*

Methodology provides the overarching approach to this research project, while both quantitative and quality methods are used to collect and analyse data.

Quantitative methods adopted in this project include 1) survey to obtain baseline data of target villages, 2) questionnaire to evaluate the effectiveness of training as well as the outcomes of interventions, 3) book log for farmers' financial data collection and analysis and 4) experimental research used by UAF team to test different production and postharvest interventions.

Qualitative methods included 1) desktop study to identify specific and useful data relevant to the project needs and to develop an understanding of current situation, 2) in-depth interviews to understand the farmers (men women and youth) as well as value chain player's behaviours and the rationale behind them, 3) observations to validate farmers' behaviour change and 4) case studies on demonstration value chains.

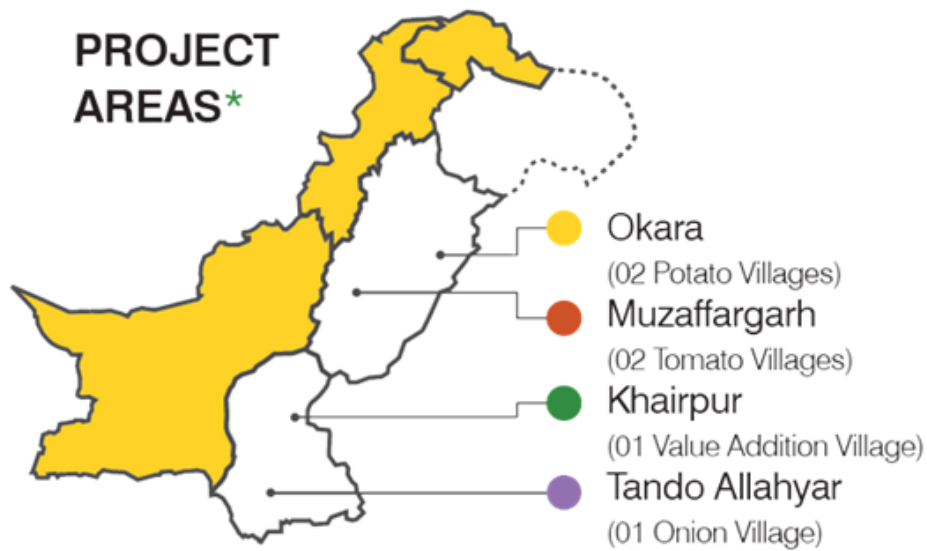
The social sciences team played a crucial role in the project by collecting both qualitative and quantitative data through baseline and end-project surveys. These surveys were conducted to assess changes in knowledge, attitudes, practices, and livelihoods among the target population. Additionally, the team conducted a training needs assessment and collected data on the social networking of farmers at the start of the project to identify the differences between male and female farmers. These data were then used to inform the design of interventions that were tailored to the specific needs of the community and to meet gender and youth inclusion. By collecting and analyzing data throughout the project, the social sciences team provided valuable insights into the effectiveness of the interventions in relation to gender and youth inclusion and identified areas where further improvements could be made. This approach helped ensure that the project was responsive to the needs of women and achieved gender inclusion in a meaningful way.

A range of monitoring and evaluation (M&E) tools were used to assess whether the proposed activities, approaches, and methods adopted by the project team were effective in achieving the desired outcomes. These tools, as outlined in the monitoring plan, collected both qualitative and quantitative information to provide credible and meaningful evidence for completed activities. The tools include the Activity Tracking Table (ATT), monthly highlight reports, field observations, and farmers' qualitative and quantitative evaluation surveys conducted by the project field team (ROs and social mobilizers) as well as quarterly reports. The collected data provided evidence of various outcomes outlined in the theory of change such as farmers' engagement, increased income, adoption of best practices, and changes in knowledge, attitude, and practices. Analysing this information helps to gain a better understanding of contributions of project approaches to the desired outcomes.

The research works in a set of focal villages where one of the target vegetable crops (onions, potatoes, and tomatoes) are a substantial component of the community’s economy. Table 1 presents the name of each focal village and its location and crop.

**Table 1:** SVVCP Project sites / villages

Crop	Province	Villages
Tomato Flagship Initiative	Punjab	Baili Janobi, Muzaffargarh District
Potato value chain	Punjab	Village 37D and Village 38D, Okara District
Onion value chain	Sindh	Village Ibrahim Shah, Tando Allahyar District
Value Addition	Sindh	Village Loung Khan Soomro, Khairpur District



Map of project locations

## 6 Achievements against activities and outputs/milestones

*Objective 1: To identify opportunities for increasing community engagement and developing rural entrepreneurship*

No.	Activity	Outputs/ milestones	Completion date	Comments
1.1	Assess gender gap by identifying men's and women's roles, access to resources, decision-making, asset ownership, control over income, community leadership, access to information, time spent on production and selling of onions, potatoes, and tomatoes and incentives from the chain at each of the selected sites in Sindh and Punjab PC, A	Completion of focus group discussions to assess gender roles in vegetable value chains.  Reports on walk-the-chain activity in Punjab and Sindh.	April 2019	Clear understanding of the men's and women's roles in vegetable value chains and training needs identified to inform entrepreneurial activities.  Appendix 1 ( <b>Report 2018-19</b> ): May 2018 Social Science Team trip report "village visits to assess community capacity"  Appendix 4 ( <b>Report 2018-19</b> ): Gender Roles in Vegetable Value Chains & Training Needs Assessment Punjab  Appendix 5 ( <b>Report 2018-19</b> ): Gender Roles in Vegetable Value Chains & Training Needs Assessment, Sindh  Appendix 6 ( <b>Report 2018-19</b> ): Desk study  Appendix 7 ( <b>Report 2018-19</b> ): Participatory Method Social Network Analysis in "Aug-Sep 2018 Social Science Team trip report"  Appendix 8 ( <b>Report 2018-19</b> ): Report of walk the chain activity in Sindh Appendix 9: Report of walk the chain activity in Punjab
		Completion of surveys to assess the gender gap in vegetable value chains.	June 2019	A draft report has been completed. The selection of villages and farmers' willingness to engage in the project was completed prior to the intensive surveys to assess the gender gap in the selected communities.

		<p>Gender Gap Report, Punjab, Pakistan.</p> <p>Sajida et.al, 2019</p> <p>Appendix 1 (<b>Report 2019-20</b>)</p> <p>Gender Gap Report, Sindh, Pakistan.</p> <p>Sajida et.al, 2019</p> <p>Appendix 2</p> <p>(<b>Report 2019-20</b>)</p>	<p>December 2019</p>	<p>Women do not have access to all five capitals due to dominant patriarchal norms, and Gender equality is considered as a challenge to masculinity.</p> <p>Understanding the gender inequality, Women's traditional role in the nursery was capitalized in tomato flagship initiative (TFI); for the onion, women's role in cutting the bulb tops and sorting was enhanced and for potato, women were engaged in grading to seed and sorting of potato after harvest.</p>
		<p><b>Tomato, potato, Onion</b></p> <ul style="list-style-type: none"> <li>• A whole family approach combined with PAR improved women engagement in all value chains.</li> </ul> <p>Appendix 8:</p> <p><b>Onion</b></p> <ul style="list-style-type: none"> <li>• Oral presentation on 'A whole family approach improves gender inclusion in onion value chain in rural Sindh' at International Horticulture Conference 2022</li> </ul> <p>Appendix 18 (<b>Report 2021-22</b>)</p>	<p>Oct 2021</p> <p>May 2022</p>	<p><b>Tomato, Potato, onion</b></p> <p>Women do not have access to all five capitals due to dominant patriarchal norms and gender equality is considered as a challenge to masculinity. Understanding the gender inequality, Women's traditional role in the nursery was capitalized in tomato flagship initiative (TFI); for the onion, women's role in cutting the bulb tops and sorting was enhanced and for potato, women were engaged in grading to seed and sorting of potato after harvest.</p> <p><b>Onion</b></p> <p><b>Oral Presentation at International Horticulture Conference 2022</b></p> <p>SVVCP team virtually participated in International Horticulture Conference 2022 for 01 oral presentation on 'A whole family approach improves gender inclusion in onion value chain in rural Sindh' at Gomal University Dera Ismail Khan, KPK Pakistan</p>
1.2	Undertake study to identify gender related rights and denials based on grounded theory to develop interventions.	<p>Completion of a report on participatory Social Network Analysis to identify gender related rights and denials.</p> <p>A gender gap report is under progress</p>	June 2020	<p>Clear understanding of gender gap with respect to institutional linkages identified.</p> <p>Appendix 7 (<b>Report 2018-19</b>): Participatory Method Social Network Analysis in "Aug-Sep 2018 Social Science Team trip report</p>

		Gender Gap Reports of Punjab and Sindh  Appendix 1, 2 <b>(Report 2019-20)</b>	February 2020	Identified the gender barriers and creating space for women by increasing opportunities  To address Gender barriers the whole family approach was followed including the male members of the family, allowing women to take part in decision-making process in all steps of three value chains
1.3	Organise suitable focal villages in Sindh and Punjab and undertake community engagement in production and marketing of onions, potatoes and tomatoes PC, A	Engaged and coordinated with 4 villages in Punjab and 3 villages in Sindh.	Dec 2018	Established relationships with communities to engage in project activities.  Appendix 2 <b>(Report 2018-19)</b> : Criteria developed for village and farmer selection "Village profiling in Punjab" & Village profiling in Sindh  Appendix 3 <b>(Report 2018-19)</b> : Criteria developed for village and farmer selection "Village profiling in Sindh
		Organised suitable villages as mentioned Potato 2 villages Tomato 2 villages Onion 1 village Chillies 1 village Value addition 1 village	September 2019	Project team worked with these farmers and building their capacity in production, postharvest, value addition, marketing and social aspects.
		Tomato (Punjab): Successful engagement of smallholder families The Foundation group consisted of 5 farmer families while the apprentice group contained 5 male, 5 female farmer workers Appendix 1  Potato (Punjab): 02 villages (communities) were engaged for interventions of the potato value chain 02 men and 02 women role models developed for the farming community. Appendix 4	Oct, 2020  Oct, 2020	The tomato flagship initiative (TFI) team has established foundation and apprentice farmers' groups in Muzaffargarh. The team is working with these farmers to build their capacity in production, postharvest, marketing and social aspects.  Two potato farmer communities have been established with the whole farmer family (man, woman, youth) approach through adopting SVVCP best practices.

		<p>Onion (Sindh) Two villages organized one for onion value chain and the other for value addition</p> <p>For the onion value chain, the team selected 01 women 02 men farmer leaders as a role models for other farmers to follow.</p>	<p>Sep, 2020</p>	<p>One onion farmer community established to build their capacity in production, postharvest, marketing and social aspects to improve the value chain.</p>
		<p>For Value addition identified 01 women 01 men to operate the 3rd business cycle</p> <p>Appendix 3 <b>(Report 2020-21)</b></p>	<p>Nov, 2020</p>	<p>In the value addition group, one farmer community was established but due to COVID-19 and lockdown situation the third business cycle was halted, again restoration of the 3rd business cycle has been started.</p>

		<p><b>Tomato</b></p> <ul style="list-style-type: none"> <li>Established engagement of 06 new smallholder families</li> <li>Training of farmers on Irrigation and nutrient management technology provided by ACIAR</li> </ul> <p>Appendix: 5 <b>(Report 2021-22)</b></p> <p><b>Potato</b></p> <ul style="list-style-type: none"> <li>Four new farmers were engaged along with 10 old farmers forming two groups in two villages in potato value chain</li> <li>10 women farmers were trained on kitchen gardening.</li> <li>20 farmers (11 men and 9 women) were trained on water and fertilizer saving technology</li> </ul> <p>Appendix: 7 <b>(Report 2021-22)</b></p> <p><b>Onion</b></p> <ul style="list-style-type: none"> <li>11 new farmers were engaged in onion group making total of 15 members.</li> <li>6 onion farmers received training on irrigation and plant nutrition management in collaboration with ACIAR to improve the engagement.</li> </ul> <p>Appendix: 12, 11 <b>(Report 2021-22)</b></p>	<p>Oct 2021</p> <p>Mar 2022</p> <p>Oct 2021</p> <p>19-Nov-2021 and -24-Nov-2021</p> <p>23 to 25-Dec-2021</p> <p>Oct 2021</p> <p>Sep 2021</p>	<p><b>Tomato</b></p> <p>The TFI team established one new apprentice farmers' group (6 male and 6 female farmers) in Muzaffargarh. The main focus has been on the previous year's apprentice farmers' group to engage and build their capacity in production, postharvest, marketing and social aspects in this year, but new apprentice farmers were also engaged in 'best practice' trainings and field days.</p> <p>CABI and ACIAR conducted a training on irrigation and soil nutrient management for 10 male farmers of tomato crop in Muzaffargarh. The trainer assembled and installed the instruments (Chameleon soil water sensors and Full Stop wetting front detectors) in a tomato field. The trainer explained that this system provides the information to support the decision making on water and nitrogen fertilizer management.</p> <p><b>Potato:</b></p> <p>Four new farmers have been engaged in potato value chain making a total of thirteen potato farmers in two groups based in two villages. These farmers received training on production, harvest and postharvest of potato value chain.</p> <p>SVVCP team arranged refresher training on importance of health and nutrition. Team guided them on production technology of different winter vegetables.</p> <p>Women farmers reported that in winter season they got financial benefits by saving of money (up to PKR 13200/-) usually spent daily on vegetable purchase.</p> <p>SVVCP potato value chain team and ACIAR organized the training of potato farmers on water and soil nutrient management technology. Farmer reported that due to correct information of availability of soil water, he has saved the cost of one irrigation.</p> <p><b>Onion:</b></p> <p>Onion VC team engaged 11 new farmers in existing farmer group</p>
--	--	---	--	--

				<p>through farmer leader to produce and market customer preferred quality onions following value chain approach.</p> <p>A three-day comprehensive farmer training was arranged at onion village Ibrahim Shah district Tando Allahyar, Sindh to enhance the capabilities of the farmers to monitor the nutrient and water requirement of their crops to save excessive nutrient and irrigation related expenses through a progressive farmer.</p>
1.4	Identify, document and address opportunities for smallholders in vegetable entrepreneurships PC, A	<p>1) Role of women in vegetable value chains: a literature report</p> <p>2) Survey of vegetable value addition products</p> <p>3) Vegetables nursery are identified as an opportunity for women and youth in Sindh</p> <p>4) A Case Study of Mango Pickle Preparation Communities in Sindh</p> <p>5) Visits of SB store (a modern retailer) to explore the possibility of linking small growers</p>	Jun, 2019	<p>Appendix 6 (<b>Report 2018-19</b>) : Report of women role in Chain</p> <p>Appendix 11 (<b>Report 2018-19</b>) Case study report on mango pickle</p> <p>Appendix 28 (<b>Report 2018-19</b>) Market survey of value addition products on retail store</p>
		Appendix 5, 6, 7, 24 ( <b>Report 2019-20</b> )	Sept 2019 - Jan 2020	Opportunities identified in target value chains,
		<p>Tomato: Value chain building opportunities identified i.e. Selection of good variety with better shelf life, adoption of best practice in raising tomato seedlings, grading, good packing material, collective marketing.</p> <p>Appendix 1</p>	Dec, 2020	Data collected during the walking the chain tomato activity were analysed and evaluated to identify and document barriers and opportunities. Based on this analysis, a plan was prepared for season 2020-21. This whole process was based on participation by foundation farmers.



		<p>Potato: Information from walking the chain was reflected and opportunities have been identified by the potato farmers i.e. seed treatment and sorting for scab reduction, sorting and grading at harvest stage, direct marketing. Appendix 4</p>	Oct, 2020	<p>The potato case study was presented to farmers who participated in walking the chain activity and said key opportunities were identified and incorporated for season 2020-21</p>
		<p>Onion: Five onion farmers were engaged and expressed their willingness to produce and market through the value chain approach and SVVCP interventions. Appendix 3 (<b>Report 2020-21</b>)</p>	Nov, 2020	<p>SVVCP onion consignment case study was presented to guide and engage the farmers in project interventions identified last year. These farmers identified new opportunities in terms of the new market, reduced market expenses, the price premium for quality produce and higher return from onion production and shared with farmer families and designed for crop season 2020-21.</p>

		<p><b>Onion:</b></p> <ul style="list-style-type: none"> <li>Farmer leader along with fellow SVVCP member farmers visited market to promote their produce</li> </ul> <p>Appendix: 14</p> <p><b>Tomato:</b></p> <ul style="list-style-type: none"> <li>Opportunities identified in tomato value chain such as being able to negotiate prices with wholesalers or retailers based on 'wish/want/walk' training, enabled farmers to say yes or no to prices they were offered</li> <li>Established nursery business enterprise and farm business enterprise.</li> </ul> <p>Appendix: 5, 6 <b>(Report 2021-22)</b></p>	<p>Nov-21</p> <p>March 2022</p> <p>June 2022</p>	<p><b>Onion</b></p> <p>Farmer leader along with RO CABI and a youth farmer visited Karachi markets to promote the quality onion meeting needs of the customer/market. They had meetings with retailer, wholesaler and exporters they showed and provided the onion samples as quality samples</p> <p><b>Tomato</b></p> <p>The conclusion of the analysis was that selling directly to Crop and Drop was the better alternative for them. A detailed financial and risk analysis of this opportunity was completed, and a plan has prepared for the season 2021-22.</p> <p>A total of 18 individual farmers, including 4 females, raised seedlings in tunnels either for their own use or for sale. An evaluation of this activity, Tomato Seedling Production in a Nursery Tunnel: a Case Study report, has been developed.</p>
1.5	Build capacity of communities to work together and establish vegetable value chains PC	<p>1) Selection of members from targeted value chain has been completed.</p> <p>2) For value addition selected 10 farmers (5 men + 5 women) were selected in the process</p> <p>3) In Sindh selected one farmer for nursery production who lead 30 farmers</p> <p>4) Identification of new community to develop value addition.</p>	<p>April 2019</p>	<p>In Sind one small-scale rural enterprise (SRE) for value addition is established in village Loung Khan Soomro</p> <p>In Sindh one vegetable nursery production SRE is under initial stage, production started in July 2019.</p> <p>Village and community at district Tando Allahyar are selected and training started in July.</p>
		<p>Appendix 8, 22 <b>(Report 2019-20)</b></p>	<p>Oct 2019 till to-date</p>	<p>The team discussed with the community to work collectively and enhance entrepreneurial skills through participatory agro-enterprise approach.</p>

		<p>Tomato: Established a nursery business enterprise by 2 female farmers while in farm business enterprise each foundation farmer adopted a more businesslike approach, for example through keeping better records and being aware of costs and returns. Appendix 1</p>	<p>Jun, 2021</p>	<p>The TFI team worked to continuously enhance the entrepreneurial skills of female and male farmers through a participatory agro-enterprise development approach. The foundation farmer group worked together in a nursery business enterprise, while on-farm business farmworkers (labour) were also involved. The hands-on training was also conducted to build the capacity of foundation and apprentice farmers. Female trainers built the capacity of female farmers and farm workers on crop management, harvesting and postharvest practices and marketing.</p>
		<p>Potato: 06 capacity building sessions were arranged for 10 farmer families who were willing to work together. Appendix 4 Appendix 7,8</p>	<p>Oct, 2020</p>	<p>Potato: 02 farmer leaders were identified who selected 08 farmer families to work with them for the adoption value chain approach. They were given training on community engagement, nutrition and kitchen gardening.</p>
		<p>Onion: Farmers proposed mixed answers. One farmer wanted to work independently while other farmers wanted to work with their landowners. An agreement between small farmers and the landholder was developed and shared based on a win-win situation by sharing outcomes and benefits. Appendix 3 <b>(Report 2020-21)</b></p>	<p>Dec, 2020</p>	<p>Establish a multi-disciplinary research team with Better Cotton Initiative (BCI) team (gender-balanced) and women social mobilizer included to engage the farmers' families through the whole family approach. The team invited the farmers to propose whether they want to work independently or in collaboration with the landowner or other fellow farmers</p>

		<p><b>Onion:</b></p> <ul style="list-style-type: none"> <li>• Two men and two women farmer leaders received leadership training to manage farmer group.</li> <li>• Farmers planning meeting to work effectively as a group</li> <li>• SVVCP team organised one field day in which 2 retailers/wholesalers participated and interacted with men farmers</li> </ul> <p>Appendix: 12, 10, 13</p> <p><b>Potato</b></p> <ul style="list-style-type: none"> <li>• Capacity of 10 farmers was built on effective leadership and group management.</li> <li>• 10 farmers were trained on collective work.</li> <li>• 09 farmers shipped their consignments collectively</li> </ul> <p>Appendix: 7</p> <p><b>Tomato</b></p> <ul style="list-style-type: none"> <li>• Training farmer leader to support the group member</li> <li>• Training on nursery best practice and Farmers collectively purchased planting media</li> </ul> <p>Appendix: 5, 6 <b>(Report 2021-22)</b></p>	<p>02 Oct &amp; 13-Nov-2021</p> <p>14-Oct-2021</p> <p>9&amp;11-Nov-21</p> <p>27-Nov, 2021 and -30-Nov-2021</p> <p>02-2-2022</p> <p>13-05-2022</p> <p>April-2022</p> <p>Nov 2022</p>	<p><b>Onion</b></p> <p>The farmer leaders learned how to lead and mentor the group members to work as a group while dealing with buyers.</p> <p>Farmers discussed the current crop situation, and developed plan to implement SVVCP harvest, postharvest and marketing interventions to work effectively as a group. 04 existing and 07 new onion farmers attended the meeting.</p> <p>1 field day was organised in which 2 retailers/wholesalers, 39 men and 30 women participated.</p> <p><b>Potato</b></p> <p>SVVCP potato value chain team arranged training of SVVCP farmers on leadership and effective group management. The group shared different responsibilities among the members including arrangement of inputs, training of new farmer member and negotiation with traders.</p> <p>This training on collective work was organised by CABI and Engro Foundation with SVVCP farmers (men and women). Farmers brainstormed on the importance of collective farming and marketing and the role of women in the potato value chain.</p> <p>Potato farmers shipped 4 consignment of high-quality potato to traders at Okara vegetable markets.</p> <p><b>Tomato</b></p> <p>The TFI team built the capacity of farmer leaders and facilitated the foundation, and apprentice farmer group leaders to identify potential buyers in Islamabad, Peshawar and Muzaffargarh. Moreover, the TFI facilitation team trained female labourer leaders to build the capacity of their field teams in harvest/postharvest best practices.</p> <p>Four women and fourteen men worked collectively to grow the tomato nursery and each farmer was responsible to look after his/her nursery trays. Group leaders ensured the agreed operational</p>
--	--	--	---	---

				mechanism of tunnels and monitored the best practices to grow a healthy nursery.
	Activities 1.1 to 1.5	Appendix 23 <b>(Report 2021-22)</b> Understanding, Integrating and Mainstreaming Gender into Vegetable Value Chains in Pakistan: An ex- post analysis of SVVCP	Dec 2021-22	<p>Following are objectives of report.</p> <ul style="list-style-type: none"> <li>● To assess the extent to which the SVVCP understood and identified the gender mainstreaming activities into selected vegetable value chains;</li> <li>● To identify the strategies that facilitated gender mainstreaming under SVVCP and reduced the gender participation gap;</li> <li>● To explore connections among rural households and the broader physical, socio political, institutional, and gendered context in which value chain development takes place; and</li> <li>● To frame the policy guidelines/suggestions for the future R&amp;D projects for effective gender mainstreaming.</li> </ul>

**Objective 2: To establish sustainable production and marketing opportunities for small-scale vegetable farmers and traders.**

No.	Activity	Outputs/ milestones	Completion date	Comments
2.1	Review and analyse previous interventions to identify technical constraints in vegetable value chains PC	Literature review on existing vegetables value chains	June 2018	Appendix 27: Literature review on vegetable value chain
		Vegetable Value chain analysis Appendix 3,4,9,10	Jan. 2020	The constraints have been identified, and possible solutions have been suggested.
2.2	Conduct capacity building for researchers and partner stakeholders to support implementation and monitoring of interventions in each crop including production and value chain development PC	1) Dr Tim Sun conducted 10 days participatory workshop on “walking the chain” 2) Dr. Tony had conducted two trainings on value chain analysis in Pakistan. 3) Dr. Gomathy Palaniappan conducted 3 workshops on Gender Mainstreaming at CABI, UAF & SAU.	May 2019	Total 137 people (34 women and 103 men) have been trained.
		Workshop for six Research Officers (ROs) on Community Engagement – 1.3	Sept, 2019	SVVCP, ROs were trained on Community Engagement.
		Two seminars conducted in SSRI to share the results of baseline data	Feb 2020	On the bases of results further trainings were designed based on participatory action approach
		Workshop on community and stakeholder analysis and market plan and gender	August 2019	16 participants including CABI team and project partners
		Workshop on value chain analysis and consignment preparation and monitoring Visiting research trials at UAF Appendix 12 <b>(Report 2019-20)</b>	July 2019  November, 2019	helping the ROs in planning and execution of research trial, preparing and monitoring consignments  Demonstration of various interventions by SVVCP production team during research trials at UAF

		<p>Continuous capacity building of 5 Research Officers</p> <p>Appendix 3 (Report 2020-21)</p>	Jun 2019	There has been the continuous capacity building of the 5 Research Officer as the in-country executors. This has been done by mentoring them by the project's Australian consultants and Dr Gomathy at every stage of community engagement and demonstration chain development.
		<p>Continuous capacity building of 3 social mobilizers</p>	Jun, 2021	<p>Timely support to the female trainer and Social Mobilizers by Dr Palaniappan has helped them to understand and overcome challenges in community engagement</p> <p>The TFI team arranged an exposure visit of the female Social Mobilizer to the Engro PAVE (partnerships and value expansion for inclusive seed systems)</p>
		<p>Tomato: Capacity of identified groups enhanced in research, governance, and financial, business, production and marketing aspects of value chain development. Appendix 1</p> <p>Potato: Capacity of 05 researchers and partners to support the implementation and monitoring of interventions in production and postharvest. Appendix 4</p>	<p>Jun, 2021</p> <p>May 2020</p>	<p>The cohesiveness of the TFI facilitation team (CABI, UAF, NARC, Agri Extension, Engro) was built on a team training workshop where the tomato flagship initiative was explained in detail and the roles and responsibilities of individual team members were clearly defined.</p> <p>ToTs were arranged by UAF horticulture team for building the capacities of field staff in production and post-harvest management</p>
2.3	Develop training modules and capacity building of the project team to develop capacity in the application of diagnostic methods of PC	<p>Training material for four crops related to production and postharvest management have been developed. Two training manuals for value addition</p>	March 2019 to May 2020	Brochures for selected crops in Appendix 13,14,18,19,20 and 21 respectively.

		<p>Two short video clips on harvest and post-harvest handling of tomato and potato crops Appendix 15</p> <p>Ten evidence reports. Appendix 16-25</p>	<p>June, 2020</p> <p>June, 2020</p>	<p>For learning under Covid19. Videos distributed and seen by farmers (60 men and 12 women)</p> <p>For learning from impact of COVID-19 on farmer farming and life and developed short videos of farmers</p>
		<p>Best practice' tomato marketing training material'</p> <p>Previously developed training materials on tomato production and postharvest practices have been updated. Appendix 2</p> <p>Video on walking the chain tomato activity</p>	<p>Apr, 2021</p> <p>Mar, 2021</p>	<p>These manuals enhanced the confidence of the farmers and team members to identify 'good' customers and discuss with them details of product specification, delivery expectations and price determination.</p> <p>A 'Walking the Chain' video was produced, narrated by a woman in the local language, to showcase the importance of females' roles in improving farm performance and facilitating joint family decision making in identifying market opportunities.</p>
		<p>Potato: Updating training modules (production, post-harvest and marketing) Appendix 4</p>	<p>Jan, 2021</p>	<p>The training modules for potato production, post-harvest and marketing management were updated and shared with farmers. Potato farmer leaders (2) were trained on best practices.</p>
		<p>Developed the marketing manual, record keeping book. Appendix 3</p>	<p>Jan, 2021</p>	<p>Onion female farmer leader was trained and women farmers were trained by the woman farmer leader on the cutting of onion bulbs.</p>
2.4	Identify constraints for each value chain PC, A	<p>1) Conducted two consultative workshops to identify constraints of target value chains</p> <p>2) Cost of Production Analysis of Potato, Tomato, and Onions in Punjab-Pakistan</p> <p>3) Diagnostic survey of the pathological issues of the production and postharvest stages of target value chains.</p>	<p>March, 2019</p>	<p>Appendix 10: Report on the cost of Production analysis of Potato, Tomato, and Onions in Punjab-Pakistan</p> <p>Appendix 22: Survey report, Led by Australian experts on virology and pathology.</p>



		Feasibility study on produce nursery by plug trays using SVVCP media Appendix 26	Dec, 2019	30 farmers expressed willingness to produce tomato seedlings using SVVCP media.
		Survey of onion and tomato nursery businesses in Sindh and Punjab Appendix 32, 33	Oct 2019	Opportunities of nursery for both male and female in villages were studied
		Market survey for dehydrated onion Appendix 34	Jul 2019	Opportunities for value addition products were evaluated
		Analysis of first business cycle of Value addition products Appendix 22	Nov-Dec 2019	The purpose was to study issues in production and marketing.
		Analysis on monthly supplies of vegetables in various markets of Punjab Appendix 35	Dec 2019	The analysis purpose to identify market opportunities. The information was shared with farmers.
		Market analysis for vegetable value added products. Appendix 36	August 2019	To identify market opportunities in district Khairpur and Sukkur
2.5	Build capacity of smallholder farmers to deliver market quality produce. PC	Record keeping training of SVVCP farmers conducted in all sites. Training women on value chain approach conducted in each crop sites used Video and PowerPoint. Appendix 3  Training women intermediary from WADO on value addition, Appendix 22 Participation of growers in Pakistan Horti Expo 2020, Lahore Appendix 38  Conduct Walk the chain activities with farmers in each vegetable site. 5 farmers walking onion chain in Sindh, 9 potato chain and 6 tomato in Punjab. Appendix 1,7 24	2021-2022  Jan 2021  Aug 2019 to onward  Jan 2020  2019-2021	Record keeping helped farmers better manage their family business. Women farmers were trained using video of walking the chain activity done by male farmers.  Women from WADO participated.  Growers developed confidence and linkages with potential buyers.  Farmer understood the quality requirements, issues in the markets, and the rationale to adopt interventions proposed for quality improvement.

		<p><b>Tomato</b> Training project team members/ researchers/ development professionals/ extensionists/Social Mobilizer/farmer leader for nursing and healthy seedlings Appendix 1</p> <p>Capacity building of foundation farmers, apprentice and new apprentice farmers and their families and field workers on production and postharvest of tomato to meet the consumer value.</p> <p>Training of female field laborers on 'best practice' including price negotiation; insect and disease identification and management Appendix: 1, 5, 6</p>	<p>Jun 2021</p> <p>June- Nov 2022</p>	<p>The training mainly built the capacity of local research team, TFI farmers, their families, and their field labourers, mainly females, participated in 3 specific training activities that were designed to increase their knowledge and skills in the areas of irrigation, transplanting, fertilizer application, insect and disease management, harvest and postharvest practices.</p> <p>4 Female labourer leaders obtained the knowledge and skills to build the capacity of their field teams in harvest/postharvest best practices. This training was useful to understand the maturity stages, grading/ sorting and packing practices to meet the consumers' requirements.</p> <p>After postharvest training of foundation farmers, they didn't experience compression damage in packing during transportation. The training to sort and grade tomatoes found to be more effective.</p>
		<p><b>Onion</b> Onion SVVCP team conducted farmers trainings (15 men and 20 women) on SVVCP the best production, harvest, postharvest and marketing practice to build their capacity to implement SVVCP best practice interventions. Appendix: 15</p> <p>Women farmers and labourers were trained on postharvest best practices including onion tops removal, sorting and grading. Appendix 3</p>	<p>Dec, 2020</p>	<p>The training ensured that SVVCP farmers produce market required quality for consignments.</p>

		<p><b>Potato</b>  Potato production and postharvest training of potato project team, extension, traders, two farmers leaders and 10 direct farmer families through demonstration plots and field visits in technical assistance.  Appendix 4,7</p> <p>Market visit by two potato farmer leaders  Appendix 4</p> <p>Leadership training and collective work training were conducted in two potato villages.</p>	2021	<p>Training women farmers and labour on sorting of unhealthy seed tubers and treatment of potato seed with fungicide for control of potato scab.</p> <p>Establish two potato demonstration plots.</p> <p>Supported eight potato fellow-farmers in the application of weedicide, fertilizers and pesticides and haulm cutting.</p> <p>Development of marketing plan with farmers for potato consignments.</p> <p>Potato farmer leaders visited vegetable markets of Lahore to identify opportunities.</p> <p>Potato farmer's groups were formed in 38D and 37D. The trainings help them in collective production and marketing.</p>
--	--	--	------	--

**Objective 3: To test and develop technical innovations for selected vegetable value chains.**

No.	Activity	Outputs/ Milestones	Completion date	Comments
-----	----------	------------------------	-----------------	----------

3.1	Develop production with gender focus to improve quality preferred by markets in Sindh and Punjab PC	<p>Two vegetable nursery tunnels installed on tomato villages for PAR research.</p> <p>One vegetable nursery tunnel was installed for preliminary research on tomatoes, onion,s and potatoes in UAF.</p> <p>Collection and evaluation of germplasm, Comparison of different nursery raising methods, Fertilizer management.</p> <p>Small interventions in onion crop for better market life and profitability</p> <p>Nursery related issues- Raising methods, Growth rate, Insect pest and disease management.</p> <p>Appendix 23</p>	2019	<p>UAF developed a local cheap media for producing disease free nursery production of tomato seedlings.</p> <p>Line sowing on flat or raised beds was identified as better methods for onion nursery production</p> <p>100 g DAP/marla was found optimum fertilizer dose for onion nursery.</p> <p>Hadaf (Quizalofop-p-ethyl) @ 150 gL-1 was found effective for weed control in summer grown onions.</p> <p>Farmers could get early onion crop by transplanting nursery (of cv. Nasrpuri) from Sindh or by using sets of about 2 cm diameter, during August.</p> <p>Onion cultivar Nasarpuri performed significantly better in some important traits (bulb weight and diameter) as compared to other cultivars</p> <p>There was no significant impact of extending the transplanting date on the onion plant or bulb related traits.</p> <p>Potential potato genotypes with high yielding potential (SL-10 &amp; FD73-73 of PRI) and early tuberization have been identified (Musica, Ruby, Berna and Lady Rosetta).</p> <p>Marketable yield of potato varieties was increased by using Isobian and fertilizers @ 100 kg N+75 kg P compared to farmers' practice (125 kg N+75 kg P).</p> <p>Increase in bulb yield (47%) due to three rows per bed with black polythene mulch have been recorded.</p>
		<p>Potato On-farm research trials through PAR approach. Appendix 39</p> <p>Conduct tomato nursery related research Appendix 57-59</p>	<p>Feb. 2020</p> <p>Jan, 2020</p>	<p>To demonstrate the impact of various interventions on control of scab, tuber cracking, and fertilizer use efficiency of potato.</p> <p>Including raising methods, Standardization of media, Growth rate, Insect pest and disease management</p>
		<p>Established two female-led tomato nursery enterprises and a farm business enterprise. Appendix 1</p>	<p>Jun, 2021</p>	<p>In this farm business enterprise, harvesting is mainly done by females.</p>

		<p>Potato: Two packages of recommendations for good practices of production were developed. The packages included capacity building of women farmers and labour on sorting of unhealthy potato tubers and fungicide treatment of seed for sowing. Appendix 4</p>	<p>Oct, 2020</p>	<p>Development of two recommendation packages by UAF horticulture team for two SVVCP villages based on the results of participatory action research trials on potato scab and soil nutrient management.</p>
--	--	--	------------------	---

3.2	Develop interventions with gender focus to improve postharvest handling, storage, packaging, and transportation practices	<p>Development of commercial quality standards of targeted four crops which have been shared with farmers and traders. The loss assessment along the chain was documented. Appendix 14 and 15</p>	April 2019	The standards are the foundation for chain members to work to produce the right quality produces
		<p>Development of Chilies Puncturing Machine to Improve Drying Efficiency</p> <p>Shelf life study of indigenous chili cultivars from Sindh province.</p> <p>Chilies under MAP wrapping maintained its marketable life for 12–15 days at room temp. and 28 days under cold storage conditions. Appendix 24</p>	<p>Feb. 2019</p> <p>June 2019</p>	<p>This developed machine can benefit growers of target villages and strengthen the dry chili market by improving its efficiency.</p> <p>The result of these researches was not adopted by farmers due to the difficulty of implementation by small farmers in the villages</p>
		<p>Storage potential of commercial tomato and onion varieties were evaluated. Appendix 40-42</p> <p>Consumer-sized cling-wrap packaging of green chillies and tomatoes was tested. Appendix 43-44 <b>(Report 2019-20)</b></p>	<p>Sept 2019 to March 2021</p> <p>Aug -Dec 2019</p>	<p>Promising varieties with good storage potential were identified.</p> <p>The consumer response was well appreciating while presentation at local retail store (SB store) in Faisalabad.</p>
3.3	Demonstration chain development	<p><b>Tomato</b> Foundation farmers and apprenticeship Farmers has been organized and trained to produce market required quality</p> <p>Identification of potential buyers for tomato consignments Appendix 2</p>	Mar, 2021	<p>Training SVVCP best practice from producing healthy seedling to post harvest handling.</p> <p>The TFI team facilitated the foundation farmer group leader to identify potential buyers in Islamabad, Peshawar and Muzaffargarh</p>

		<p><b>Onion</b> Five onion farmers and families are trained to implement SVVCP interventions through labour to produce high-quality onion. The quality of cutting, sorting, grading &amp; packing by labour is improved as compared to the previous consignment. Appendix 3</p>	Jan, 2021	The capacity enhanced in postharvest activities for the compliance with trader's requirements, Women labour trained by women farmer leaders.
		<p>SVVCP farmers visited traders in target market and traders visited the onion village to build relationship.  Appendix 3</p>	Jan, 2021	<ol style="list-style-type: none"> <li>1. Meeting with Onion wholesaler (new &amp; existing)</li> <li>2. Onion trader visited onion village to meet SVVCP farmers for business opportunities</li> <li>3. Onion Farmer visit to Market to finalise the consignment deal</li> <li>4. Onion exporters are attracted to buy SVVCP quality onion</li> </ol>
		<p>SVVCP team organised one field day in which 2 retailers/wholesalers participated and interacted with farmers</p>	9&11-Nov-21	<p>Field day was organised in which 2 retailers/wholesalers, 39 men and 30 women. The retailers/wholesalers described the current market structure and practices. They encouraged farmers and expressed willingness to work farmers who are willing to adopt interventions.</p>
		<p><b>Potato</b> The package was developed based on surveys with potato traders at Okara and Lahore.  Two meeting were arranged between the two farmer groups and two potato traders for planning of potato consignments. Appendix 4</p>	Jan to Feb 2021	<p>One package of interventions on postharvest operations (sorting, grading, packaging and storage) based on market requirement was developed for the two farmer communities.  Farmers and traders agreed to finalize sale plan for current potato season.</p>

		<p><b>Tomato</b> Monitoring of postharvest practices by farmers' group leaders during tomato consignment Appendix: 6 <b>(Report 2021-22)</b></p>	June 2022	<p><b>Tomato</b> .</p>
3.4	Test the benefits of interventions through conducting trail consignments	<p><b>Onion</b> One consignment in 2019-2020 Six consignments in 2020-2021 20 consignments to wholesaler, retailer and exporters in 2021-2022 Appendix 16, 24</p> <p><b>Potato</b> One consignment in 2019-2020 Four consignments in 2020-2021 Six consignments in 2021-2022 Appendix 7</p> <p><b>Tomato</b> Two consignments were delivered in local wholesale market and Crop Drop 2021 Appendix 2 TFI farmers' groups delivered the 'best practice consignments in 2022 to commission agents, wholesaler and fair price retail shops in Muzaffargarh. All consignments were monitored. Appendix 2,6</p>		<p>The consignment includes following activities: 1) Market visits prior to activity 2) Farmer selection and training 3) Consignment preparation and market delivery 4) Financial Evaluation comparing conventional practice 5) Market response 6) Consignment report</p> <p>All research teams working with SVVCP farmers to monitor the consignments and to collect data and document the impact of the adoption of postharvest 'best practice'</p>



3.5	Develop interventions with gender focus to enhance value addition and marketing in target value chains	<p>03 PFTS session was conducted for capacity building of farmers regarding value addition and new product development, packing, labelling and marketing at village Loung Khan Soomro Appendix 12</p> <p>Conduct value addition products market survey Appendix 13</p> <p>Evaluation of 20 value-added vegetable products developed by SAU for suitability to village production Appendix 17</p> <p>Analysis of selected 5 products-</p> <ul style="list-style-type: none"> <li>● Nutritional Facts</li> <li>● Organoleptic analysis</li> </ul>	2018-2019	These research activities were conducted by SAU
		<p>The value addition SRE members conducted 2 of 3 planned business cycles of green chili chutney production and marketing Appendix 22</p>	Oct 2019 till to-date	
		<p>Third value addition business cycle to be concluded in Jun 2022 Appendix: 20, 18</p>	Jun 2022	One value addition SRE member and his family ran value addition business by adopting value chain approach in the third business cycle. They have added up an additional PKR 4,612 in their monthly family income.
3.6	Out-scaling of interventions via FFS and field days PC	<p><b>Onion</b></p> <p>1) The total number of PFTS 14 The total number of participants men, women and youth 86</p> <p>2) The total number of Field Days 3 The total number of participants 269</p>		

		<p><b>Tomato</b></p> <p>1) The total number of PFTS 26 The total number of participants men, women and youth 170</p> <p>2) the total number of field Days 5 The total number of participants 443</p>		
		<p><b>Potato</b></p> <p>1) The total number of PFTS 17 The total number of participants men, women and youth 45</p> <p>2) the total number of field Days 4 The total number of participants 368</p>		

**Objective 4: To scale-out improvements in vegetable value chains, and sustain and maximise community benefits.**

No.	Activity	Outputs/ milestones	Completion date	Comments
4.1	Appraise the performance of project partners using a KPI-based M&E system	Developed Project KPIs	Sep 2018- Apr 2019	
		Developed project KPIs, IPA report	Jul 2020	
		Monthly highlight reports, Activity Tracking Table (ATT), Progress of project KPIs for three value chains Appendix 5 <b>(Report 2020-21)</b>	Jun, 2021	These tools helped to manage the project activities vs progress and way forward
4.2	Assessment of technical and social impacts made by project interventions in target communities	Evaluation data of twenty-eight trainings was collected and analysed Report 2018-19	April 2019	On the basis of results further trainings were designed using participatory approach
		Evaluation of Farmer engagement by analysis of feedback from men and Women from villages	Jun 2019 - Feb 2020	The evaluation showed that value chain approach incorporating a PAR methodology within a whole family context, deliver benefits for smallholder farmers and women

		Onion and potato value chain team conducted quantitative survey of target villages to evaluate farmers' adoption and reasons for adoption as well as for no-adoption interventions Appendix: 09, 21	June-Sep-2021	The survey showed very positive results of the activities and efforts done by the SVVCP project.
4.3	Connect smallholders, women and youth, vegetable entrepreneurs with financial agencies	Meeting with MDF for financial support of value addition enterprise of SVVCP		Two meetings with MDF management conducted
		Meeting with retailer/wholesale/retailer for financial support of value addition farmers	Oct 2019-Jul 2020	Initial agreement was made and did not carried out due to covid.
		Meeting with Mojaz Foundation for financial support for nursery business	Jul 2019	Mojaz Foundation agreed to provide microfinance access to SVVCP farmers, but not happen
		Initiation of grant package with VCTAT. Two proposals on nursery business and value additions have been submitted, Appendix 60	Apr 2020	
4.4	Engage policymakers in order to demonstrate, discuss the effectiveness of the project model, and to advocate for wider adoption PC	Pakistan visit by ACIAR project manager Ms. Irene Kernot to discuss with different Govt. and corporate organizations the opportunities	Oct 2019	
		Senior officials from Hort. Ext Punjab attended a tomato field day	Feb, 2021	They offered assistance and intention to scale out next season
		2 meetings were conducted to share the tomato interventions and their results. Additional Chief Secretary Agriculture South Punjab also visited tomato village and hold a meeting with farmers.	Jun, 2022	2 meetings were conducted to share the tomato interventions and their results. Additional Chief Secretary Agriculture South Punjab also visited tomato village and held a meeting with farmers.

4.5	Capacity building for scaling out	<p><b>Onion</b> Training on value chain as well as whole family approach conducted for Extension Sindh staff in which 10 extension staff members (6 men and 4 women) and 3 CABI staff members were trained (2 men and 1 woman) Appendix: 16</p> <p><b>Potato</b> 7 extension workers (5 men and 2 women) were trained on potato value chain and whole family approach Appendix: 7</p> <p><b>Tomato</b> 9 extension workers, 2 new CABI staff, one PARC and one from Engro were training on tomato value chain and whole family approach. Appendix: 5</p>	<p>07 Jan, 2022</p> <p>23-Jun-2022</p> <p>June, 2022</p>	<p>Three to four days' workshop &amp; walking the chain activity were conducted to build the capacity of Agri Extension Punjab and Sindh and PARC staff. Five new members, from CABI, were also trained under same programme.</p>
		<p>The project has developed a scaling out strategy for the crops for sustaining the partnerships of the existing project implementing partners after the project life. Appendix: 5, 6, 7, 16</p>	<p>Oct-2022</p>	<p>The project work in 2021-22 focused on scaling out the SVVCP best practices has indicated that despite the success in motivating farmers to adopting SVVCP best practices in target villages, the scaling out beyond these villages and to other vegetable crops need to develop a comprehensive scaling out strategy.</p>

---

## 7 Key results and discussion

### 1. Research Methodology

The project has applied value chain theory combined with a participatory approach and whole family approach to local rural vegetable farming communities in Pakistan to improve small farmers' livelihood sustainably.

The project methodology was an integrated and multidisciplinary approach, a model that was first time implemented at the community level. The model has been proven to be effective and successful. The value chain approach, the centre pillar of the SVVCP strategy - a market-led approach, changed smallholder farmers' attitudes and behaviours and proved effective in developing market-led thinking with consumer value focused on beneficiary farmers. Participatory action research activities, guided by a value chain approach including farmers' walking the chain, conducting consignments, and setting up intervention trials in farmers' fields, have created a great incentive for farmers to adopt value chain interventions proposed by the project. Farmers' attitudes and behaviours have shifted from production-led only to market-orientated also.

A successful application of the value chain approach with farmers' participation requires the support and facilitation of a professional research team. Each activity requires the research team to develop a detailed plan in consultation with farmers. Reflection with farmers after each activity needs to be conducted for learning and improving purposes.

The whole family approach worked well in terms of better gender and youth engagement, where women were more involved in field activities. It led to improved adoption of interventions. In three value chains, women social mobilizers and female trainers successfully engaged the farmer families overcoming the entry barriers of restrictive gender norms and enabling conditions to participate in value chains such as planning crop production, postharvest, marketing practices, and value addition. However, the level of involvement of women varies from village to village. In the tomato and potato villages in Punjab, the whole family approach is more effective compared to the onion village in Sindh where women from certain castes could not be engaged in field activities.

The whole family approach cannot achieve its desired outcomes without employing women social mobilizers to work in each village. To build relationships and trust, social mobilizers need to frequently visit individual families in the villages, a key to bring women and youth in the families to value chain activities.

Under the overarch of the research methodology, qualitative and quantitative research methods were used for data collection and analysis, for the purpose of the assessment of the effectiveness of the model to achieve its objectives and outcomes. The data collection methods were rigorous to ensure data quality and reliability with no biases. Farmers self-reported marketing data was cross-checked by interviewing the traders. M&E related data were collected and analysed and verified by M&E team at regular intervals including interviewing the farmers during multiple field visits of project villages throughout the project life.

The strength of this model is the sustainability of the demonstration value chains developed by the project. The model treats the whole value chain from production to consumers as a system with the objective to create consumer value with profits, to be fairly shared by all the chain members. It is a win-win situation for all chain members. The limitation is the requirement of a multidisciplinary research team during the implementation of this model. Forming such a research team is challenging in most development countries. The other limitation to this model is the requirement of a longer project duration for the full implementation of the project objectives. Five years duration has allowed the project to develop demonstration value chains in the target local communities. More time is needed for scaling out to wider communities.

## 2. Vegetable Value Chain Development with gender inclusive

The project has developed three successful vegetable demonstration chains, onion in Sindh, tomato and potato in Punjab respectively. The success of the three value chains is evidenced by 1) Significant financial benefits that small farmer households received through their adoption of the value chain interventions, 2) High adoption rate of these interventions by small vegetable farmers in the project villages and 3) Strong women engagement in value chain and their social and economic benefits from participating value chain activities.

### 1. Community engagement

In the initial scoping of the SVVCP project, the current project villages were identified as potential focal villages as per criteria set by the social sciences team.

In 2018, a Training Needs Assessment was conducted in these villages. This assessment, which involved both male and female smallholder farmers, identified major training needs for three vegetables included:

1. Quality seed (potato and tomato)
2. Nursery management (tomato).
3. Nutrient management (potato).
4. Pest and disease management (tomato and potato).
5. Harvest and Postharvest best practices
6. Better linkages with markets (tomato, potato and onion).

In 2019, a farmer group of 5 was engaged in the start in onion village and delivered one commercial onion consignment. This farmer group extended to 7 in 2020 with 6 onion consignments delivered alongside the establishment of a new group of two women. In 2021, the men farmer group extended to 15 farmers and women group to 13 women (including women farmers and labourers) and a total of 20 consignments were delivered.

For potato, 2 communities, each from village 37D and 38D were engaged for project activities. In season 2020-21, there were 7 farmer families (11 men, 7 women, 2 youth and 3 labour) engaged to adopt value chain interventions which increased to 10 farmer families in season 2021-22 with 19 men 9 women, 4 youth and associated labour.

In Potato VC, Initially, there were restrictions for participation of women in training sessions however kitchen gardening was adopted as strategy to improve gender engagement. Training on kitchen gardening started in 2021. Initially, 3 women from village 37D adopted which inspired other women in 37D and 38D, who now have reached a number of 22 kitchen gardening plots in both villages. They are getting support from their family and community. Improved health, extra money, fresh and nutritious vegetables were additional outcomes of this strategy apart from increased women engagement in value chain activities.

In tomato village, where most smallholder farmers are tenant farmers, a foundation farmers group was established in 2020-21 which was consisted of 5 male-led farmer families and 2 female-led farmer families in village Baili Janobi. A second group from the village, the *apprentice* group, was encouraged to be involved in any training activities as preparation for them to become the focal group for the 2021-22 season activities. The team worked with these farmers by building their capacity in production, postharvest, marketing and social aspects. A total of 15 farmers have adopted the SVVCP tomato best practice to prepare commercial tomato consignments during the 2021-22 season. The outcomes from the 2020-21 and 2021-22 seasons value chain strengthening activities encouraged other smallholder farmers in Baili Janobi and the nearby villages of Haijiwah and Jagat Pur to

engage in SVVCP activities. The number of farmers has reached 24 farmers' families in both villages by 2022-23 season.

These successful outcomes were attributed to multiple success factors such as limited farmers numbers in start, presence of respected and motivated farmer leaders in men and women, active participation of farmers families, gender balanced facilitation team and detailed planning and execution of project activities. SVVCP project approaches; participatory action research and whole family approach helped to reach more family members including women and youth by recognised their roles and provided opportunities such as knowledge and skill enhancement for all family members to engage in different aspects of value chain approach and decision making. Women leadership also emerged in all value chains based on these interventions in nursery business and postharvest crop handling in target vegetable value chains. Farmers were actively involved in value chain activities from planning to feedback.

Following lessons were learned for effective community engagement.

- The R4D projects should start with a group of small number farmers (2-5) who are progressive, motivated and committed rather than training many farmers and act as a role model at the later stage for other farmers to follow.
- Right farmer leader should be selected in each village as his/her role is critical. Selection should be made carefully through interviewing farmers in the village based on personal traits and existing local leadership.
- Farmer group formation in each village should be led by the farmer group leader as he will select farmers he trusts and can work with.
- Active involvement of farmers in planning, developing the package of interventions and feedback enhances engagement in value chain activities.
- Conduct commercial consignments to demonstrate the financial outcome of interventions. Evidence speaks louder than words. Most farmers are not willing to take risks of trying new practices unless they observe the benefit from neighbouring farmers.
- The gender sensitive nature of the designed intervention packages helped the facilitation team to increase gender engagement in value chain activities.
- Frequent visits and communication with farmers by the facilitation team to build trust through discussing issues and challenges regarding the adoption of interventions introduced by the project.
- Establishing production field trials in the village is important as farmers can participate in training through the trials and observe the difference in yield and quality.
- Off-season engagement activities such as training women in kitchen gardening plays an important role in the engagement of women in potato value chain activities as it develops the trust between the community and the facilitation team. Similarly training on safe pesticide usage and on-field compost forming in onion village improved community engagement.
- Recruiting women social mobilizer in facilitation team to access women.
- Capacity building of research officers and social mobilizers for engagement is indispensable.

## **2. Financial benefits**

Significant financial benefits were received by the smallholder SVVCP farmers across the target value chains. These financial outcomes include higher gross margin (86%, 147%, and 121% in tomato, onion and potato VCs, respectively); and increased average price compared with market price (PKR 11/Kg, 30%; PKR 5.5/Kg, 26%; PKR 4/Kg, 22% in tomato, onion and potato, respectively). The crop yields have increased by 18%, 23%, and 20% in tomato, onion, and potato respectively.

The premium prices received by the SVVCP farmers were due to:

- 1) Early harvest for the tomato crop to fetch a good market price – due to the adoption of nursery and production 'best practices' (tomato).
- 2) The premiums paid for better quality produce due to the adoption of SVVCP best practices.
- 3) Storage (short/long term) to manage price fluctuation in market (potato) and
- 4) Direct marketing

The wages of trained labours working for SVVCP farmers were increased, an additional PKR 100/day for potato labors and PKR 20/bag for onion labours. Women farmers with potato value chain have saved PKR 10,000 per season due to establishment kitchen gardening plots

Apart from the fresh vegetable value chains, four women working with nine men collectively to grow the tomato nursery and each farmer was responsible to look after his/her nursery trays. They sold 19,000 seedlings in 2021-2022, which increased household income by PKR 15,200 in total.

In the case of value addition business, over the last twelve months, the business showed a steady and sustainable progression and the family had a turnover of PKR 57,850, with a net profit of PKR 18,687 t. The results demonstrated the potential of value addition as a business opportunity for smallholder rural families, especially for women and youth to improve their livelihood. These successful financial outcomes were achieved through following factors.

- The walk the chain activity across all the value chains were conducted with farmers which enabled farmers to identify and analyse potential market opportunities available to them and equipped farmers with knowledge and skills to develop market strategy.
- Multidisciplinary team used whole family approach along with PAR to train and facilitate farmers and their labour (men and women) to engage in preparation of high-quality consignments by following best practices to create customer value in their produce leading to customer satisfaction, higher returns and forging long-term relationships with buyers through post-marketing feedback system to ensure quality supply on sustainable basis.

Major lessons include

- There is a great variation in yields among SVVCP farmers and the reasons behind need to be explored
- Farmers who adopted best practices may not necessarily make profit due to market price fluctuation in the harvest season. However, their loss was much less compared to farmers who did not adopt

### **3. Wider adoption of value chain intervention in local farming communities**

Based on observing the financial outcomes of SVVCP farmers, wider farmer adoption of best practice interventions was noticed. The onion village has total 250 householders and among them, 201 householders grew onion crop in 2021-2022 season. The project surveyed 196 farmers growing onion and 194 of them have adopted the project interventions, an adoption rate of 98%. The average volume produced by each onion farmer who adopted the interventions was 26.5 tonnes. The total volume of intervention onion produced from this village was 5140 tonnes, more than 500 commercial trucks of 10 ton capacity. Although the onion local market prices in the 2021-2022 season were relatively low compared to the previous year. The average price the village farmers received from their intervention onions was PKR 812/kg, 67% above the average local market price. Six traders in Karachi market who purchased onions from this village were identified and interviewed. They reported having purchased a total of 2550 tonnes of intervention onion



from this village and paying a premium to farmers. All their purchasing was exported because the onions were properly sorted, graded and had much longer shelf life.

In case of potato VC, a survey for general adoption of interventions was conducted with farmers who grow potatoes in villages 37D and 38D in season 2021-22 (77 farmers). 80, 85 and 70% of potato farmers in the two villages adopted pre-sowing seed sorting and treatment, postharvest sorting and grading and collective marketing, respectively. The total production of intervention potatoes in the two villages was 2591 tonnes, 43 tonnes or 389 bags (110 kg) on average from each farmer. The average local market price in the 2021-2022 season was PKR 1464/110 kg and the average price the village farmers received from their intervention onion was PKR 1738/110 kg, 18% increase compared to the average local market price. Given the adoption of SVVCP interventions increased production cost PKR 37/bag and price received from the market increased PKR 274/bag on average, the net profit for each farmer from adoption interventions increased PKR 91998.

Major success factors contributing to wider adoption are given as under;

- Higher profit margins of SVVCP farmers inspired other farmers to adopt.
- Minimum/no adoption cost to implement interventions. Involvement of farmers in developing the package of interventions enhances the adoption
- Training of fellow farmers by the SVVCP farmers
- .
- Farmer leaders play an important role in training SVVCP as well as non-SVVCP farmers.

### **3. Test and Develop Technical Innovations**

#### **Onion**

A series of experiments on onion crop production was conducted by the UAF production team. Results showed that 1) line sowing on flat or raised beds was identified as better methods for onion nursery production, 2) 100 g DAP per marla was found optimum fertilizer dose for onion nursery, 3) Hadaf (Quizalofop-p-ethyl) @ 150 gL<sup>-1</sup> was found effective for weed control in summer grown onions, 4) Onion cultivar Nasarpuri performed significantly better in some important traits (bulb weight and diameter) as compared to other cultivars, 5) There was no significant impact of extending the transplanting date on the onion plant or bulb related traits and 6) Farmers can get early onion crop by transplanting nursery (of cv. Nasarpuri) from Sindh or by using sets of about 2 cm diameter, during August.

Research trials on extending onion shelf life through stopping irrigation, curing, and grading conducted by UAF postharvest team showed that bulb hardness retained for extra 35 days, marketability sustained for extra 35 days with <20% weight loss. Well-cured and well-graded onions exhibited a 2.5-fold increase in storage life as compared to traditional onions. The results were confirmed by the laboratory research trials at University of Agriculture, Faisalabad (UAF), which indicated the bulb shelf life was extended by 75 days by using the intervention package. The extended shelf life was critical for farmers as well as market actors to capture the best value and reduce wastage. The wastage was less than 1% with SVVCP farmers comparing to 5-13% with traditional farmers, a significant reduction.

Testing and monitoring the consignments data indicated that 64% increase in profit comes from quality improvement through stopping irrigation, curing, proper bulb tops removing, sorting, grading, and 11% from direct marketing.

#### **Tomato**

The major technical innovation developed by the UAF production team and tested and adopted in the TFI was the raising of seedlings in a nursery tunnel as opposed to the field. Farmers were able to produce excellent seedlings by using locally developed growing media by coco coir, rice hull ash and sugarcane press mud with 30:30:30 ratio (substituting

peat moss). Post-planting mortality rate of nursery was significantly reduced by using plug seedlings compared to conventional bare rooted soil grown nursery. This ensured the required plant density and reduced cost of replanting. The average cost of production per seedling transplanted or sold was 32% lower in plug seedlings. Plug seedlings started earlier growth after transplantation, compared to bare-rooted seedlings, resulting in vigorous plants and two weeks early harvest to capture high early-season prices.

On-farm research trials through the PAR approach have tested the impact of various interventions on tomato quality. The quality and quantity of marketable tomatoes of SVVCP demo plots were found to be higher on an average 54% and 43% respectively, and wastage from demo plots was four times less, compared to conventional practices.

### **Potato**

A series of experiments on potato crop production was conducted by the UAF production team. The experiments showed that 1) potato genotypes SL-10 & FD73-73 of PRI have high yielding potential and potato genotypes Musica, Ruby, Berna and Lady Rosetta have early tuberization, 2) Marketable yield of potato was increased by using Isobian and fertilizers @ 100 kg N+75 kg P compared to farmers' practice (125 kg N+75 kg P) and 3) sowing potato using three rows per bed with black polythene mulch increased bulb yield by 47%.

UAF Production team identified potato skin diseases as a major constraint diminishing the quality of produce. Three interventions including using 2nd generation clean and healthy seed, pre-sowing seed treatment and application of gypsum at sowing were tested through participatory farmer field trials in the selected villages. The interventions significantly reduced the scab as compared with conventional practices, i.e., 6.8, 5.8 and 5.3% lesser intensity with 2nd generation seed, pre-sowing seed treatment and application of gypsum respectively.

UAF Post-harvest team introduced the farmers to good practices of sorting, grading and in-field storage. With improved skills, farmers sorted the damaged tubers at harvesting and temporarily stored potatoes for 40 -50 days at their farms. This practice slowed down storage deterioration and thus reduced the wastage from 10 bags to 3-5 bags/acre. The appropriate grading for ware potatoes (>90g) ensured uniformity of tuber size for which customers had been willing to pay a premium price.

### **Value addition**

In value addition research, the SAU food technologist developed the product recipes based on market research and consumer preferences and identified its critical control points and semi-processed vegetable storage technology for the recipe. The intervention was designed to store cheaper vegetables for long term availability of raw material to avoid purchase of vegetables when prices are higher. I. Through this intervention, vegetables can be stored for 8 months. A business model was developed by the project team based on the experience of learning through three business cycles of producing and marketing value addition vegetable products. The model can be used for scaling out this case study to other villages.

### **Lesson learned:**

- Smallholder farmers should be involved through PAR approach in all stages of the research, particularly in the planning phase of the research, to maximise its benefits for the smallholder farmers in local context.
- Socio-economics and skills set of small farmers need to be considered when planning for testing and developing new innovations and technologies.
- The interventions identified may not be novel or innovative in the national/international context but those may be new for the beneficiary small landholder farmers and capable to produce desired outcomes such as superior

quality or yield in the local context to create customer value identified in market research.

- The recipes of value-added products which are developed by food technicians in labs could face great challenges to produce the same quality in the rural uncontrolled environment.
- Existing national programs and institutes should be engaged in the project based on their potential scope, contributions and versatility in technical skills for facilitation team for superior results, adoption and building local technical manpower.
- Extension services need to be improved because provision of basic technical knowledge can enhance the on-farm productivity and profitability of smallholder farmers.

#### **4. Capacity building**

Capacity building elements were built into the design and delivery of every area of activities in the project, from field days to on-farm activities, to marketing research, to production and financial evaluations, to women's nursery, farm business initiatives such as nursery and value addition. The capacity building of facilitation team members and farmer leaders was focused on the integration of community engagement, value creation and gender inclusiveness in value chain development.

The typical method of delivering capacity building was by direct hands-on participation of farmers in activities such as walking the chains, meeting with traders for relationship development, variety selection, sorting, grading and packing based on consumer preferences, training and mentoring other farmers and female labourers, direct price negotiation, financial record keeping and field days presentations.

Over the five-year life of the project, 12 male farmers including two farmer leaders in the onion village, 19 farmers including 5 foundation farmers in tomato villages and 10 farmers including two leader farmers in potato village have been trained through participating in the above-mentioned activities.

Most importantly, these activities emphasised the critical importance of adopting a whole of chain approach in solving problems and addressing opportunities for smallholder farmers. These activities build capacity of the farmers to conduct market research to identify and evaluate potential opportunities and design interventions to materialise the opportunity by delivering high quality produce to meet their buyer's requirement. For instance, in case of all value chains, farmers conduct walking the chain activity to learn new buyers in potential market segments i.e. retailers. They evaluated the identified opportunities and decided to work with selected buyers (retailer, wholesalers and exporters in onion VC; retailers, commission agent in tomato VC; and wholesalers in potato VC). These farmers, with the help of facilitation team, designed intervention packages to produce and deliver customer valued quality. The farmers communicated with these buyers throughout crop cycle and received feedback after the consignment delivery to further improve the quality for next season. This approach helped farmers to satisfy their customers and develop long term relations with their buyers.

In contrast to the Agricultural Hub Program that has as its focus a 'progressive and socially accepted farmer', this project has focused on small groups of progressive and motivated smallholder farmers. The advantage of focusing on a group of farmers is that the members of the group provide support for each other during the challenging change process. Across the three value chains, farmers leaders supported member farmers in terms technical advice, market linkages and price negotiations. Moreover, SVVCP farmers also provided on-farm technical support to other non-SVVCP farmers to produce high quality vegetables to meet customer needs.

In contrast to the traditional 'information transfer' approach, the participatory approach adopted by this project had 3 important elements:

- The training activities were based on the needs of the smallholder farmer group members,
- The training activities were scheduled in consultation with the farmer group leaders,
- The training activities involved the active (hands-on) engagement of the participants.

The success of any capacity building activity is highly dependent on the competency and skill of the facilitation team implementing the process, therefore to build the capacity of Pakistan facilitation teams, Australian experts mentored and supervised 8 project research officers (2 female) and 3 female social mobilizers through the annual project review and planning, co-development with facilitation team members on community engagement, value chain analysis and feedback on proposed activity plans, data analysis and interpretation, and activity reflection reports.

Australian experts developed capacity of facilitation team through walking the chain and workshops to conduct market research, value chain analysis, designing and implementation R4D interventions, collaboration with partners, financial analysis and reflection. Australian team mentored the ROs at planning, execution and reflection phases of each activity to enhance its effectiveness. Social sciences team trained ROs and social mobilizer on gender awareness and inclusion through multiple hands on trainings and workshops for successful community and gender engagement.

Capacity of staff of Department of Agriculture, Extension wing was built to embed the SVVCP project approaches in the existing extension system to empower smallholder farmers and their families. A pilot program, designed to build the capacity of Extension Officers in the value chain approach, was conducted in TFI in 2021-22 season. Six Extension Officers and 2 Officers from PARC participated in this program. The feedback from the participants would indicate that the building of their knowledge and skills in the value chain approach is a work in progress. The main reason for this outcome is that the empowerment process adopted in the TFI is innovative in its focus (market-led versus production-driven), its scope (from consumer to farmer) and its andragogy with experiential learning (participatory and inclusive) when compared with traditional extension practices in Pakistan.

A season-long comprehensive training program was conducted in potato VC for 6 extension officers (4 male and 2 female) from Provincial Agriculture Extension (PAE) which included training workshop for the basics of value chain approach and hands-on experience in potato farming system. Onion VC team also conducted a 4 day participatory action training on value chain as well as whole family approach to 10 extension staff members of Sindh (6 men and 4 women) and 3 CABI staff members (2 men and 1 woman) were conducted. The feedback after training indicated that the activity was able to increase awareness of these approaches. However, it was not sufficient for them to work independently for scaling out. Trained extension staff published an article on the value chain in the local popular magazines of Agriculture Extension Sindh and Sindh Agriculture University, Tando Jam, suggesting their interest to promote project approaches.

It is concluded from these training activities for extension officers that a long-term capacity building program needs to be designed to build the capacity of extension officers in this innovative empowerment process requires a long-term commitment and support for organizational change.

## **5. Scale-out**

The scale-out activities include farmer field days, training manuals development, conducting participatory farmers training sessions (PFTS), publications and the development of videos of walk the chain for training of village women. And also developed videos for farmers, public and private organizations to promotion project approaches and results of interventions.

## **Onion**

A total of 224 men, 96 women and 35 youth have participated in PFTS and farmer field days. The effectiveness of these scaling out activities was evident by

- The high adoption rate by farmers in the onion village. A survey of 196 onion farmers conducted in 2021-2022 showed 61 percent fully adopted and 38 percent partially adopted SVVCP best practice interventions.
- Onion farmers, from the neighbour villages, who participated the farmer field days delivered four commercial consignments of SVVCP best practice onion and secured 12 percent higher price as compared to the market rate of the day.

## **Tomato**

A total of 157 male, 67 female and 17 youth farmers beyond the foundation group participated in the training and farmers field days. These trainings/ field days were conducted in the fields and participants were able to differentiate between foundation farmers' the best practice fields and traditional farmer fields e.g. healthy tomato nursery, crop condition etc.

## **Potato**

A total of 24 men, 17 women and 4 youth farmers participated in farmer field school (FFS) and 368 farmers participated in the farmer day. The scaling out activities were effective. The survey of potato farmers in 37D and 28D indicated that 51% of farmers have fully adopted the SVVCP best practice interventions and 47% of farmers partially adopted the interventions.

## **Key success factors and lessons**

In the context of community engagement, there are 3 aspects to scaling out:

1. The transfer of knowledge and skills acquired by farmers to other farmers in the community.
2. The transfer of knowledge and skills acquired in the SVVCP project to other crops grown by the SVVCP farmers.
3. The transfer of knowledge and skills acquired in the SVVCP project to other institutes and organizations working with rural communities.

## **Transfer from farmer to farmer**

A good indicator of the success of farmers to other farmers' transfer is the onion and potato community survey results. In the onion case, 48.5 percent farmers learnt interventions from SVVCP training demonstrated by SVVCP farmers, 26.8 percent from farmer relatives and 20.1 percent from friends. In the potato case, 30 percent farmers learned from SVVCP farmers and 30 percent from their friends/relatives/neighbour. In the tomato case, TFI farmer groups were used to present and demonstrate their new practice to other farmers. The quality of transfer to other farmers depends on how well the SVVCP farmers were trained. Therefore, capacity building focusing on small groups of farmers is critical for facilitation team for future scaling out to other farmers

## **Transfer to other crops**

SVVCP farmers in the onion village have applied their value chain to other vegetable crops. Onion farmers visited Karachi market and discussed with traders on quality requirements of these vegetable crops and issues. TFI farmers in the tomato village can also be seen by their willingness to apply this knowledge and skill in the growing and marketing of their other crops. The big challenge facing farmers in transfer to other crops is the technical support from production and postharvest experts after their identification of market opportunities and quality issues. Most farmers have limited knowledge of what causes the quality problem and how to deal with it.

### **Transfer to other institutions**

NARC team incorporated whole family, value chain approaches in their research and training farmers and community interaction. UAF production, postharvest and marketing teams incorporated value chain approach in their teaching curriculums.

10 extension staff in Sindh and 12 in Punjab were trained by the project. Preliminary feedback from the participants in this training program suggested that they require further training and support before they felt capable of leading a similar initiative.

---

## 8 Impacts

---

### 8.1 Scientific impacts – now and in 5 years

As an R4D project, the SVVCP has demonstrated the following in the context of smallholder farmers:

- The ‘whole family’ approach is effective in gender engagement.
- The value chain approach is effective in enhancing the income of smallholder farmers.
- Participatory action research is effective in increasing farmers active engagement and effectiveness of project activities including capacity building and implementation through active involvement in activities starting from planning to reflecting and feedback.
- Gender mainstreaming is possible in a sensitive socio-cultural environment.
- A ‘whole family approach’ adopted across the three crop value chains has resulted in a significant increase in the involvement of women and youth.

The UAF Postharvest team developed research-based technical interventions to improve quality and shelf life of onions. These interventions included evaluation of storage potential of commercial tomato and onion varieties, and evaluation of curing technique for long-term storage of onion was optimized. Onion curing studies showed that proper curing of onions significantly extends their marketable life.

In value addition, the project team developed product of green chili chutney with safe production methods and the team has developed a standard recipe is developed from healthy ingredients. Semi-processed storage for vegetables were tested and introduced to store cheaper vegetables for long term availability of raw material and to avoid purchase of vegetable when prices are higher. Through this intervention, vegetables can be stored for 8 months.

The Research methodology adopted in this project is unique in ACIAR projects. This was the first time such an integrated and multidisciplinary approach was implemented at the community level. The project focusing on introducing a package of interventions to small farmers for the purpose of creating consumer value was also novel although none of the technical intervention introduced in the project was very novel and new. The scientific impact of this research model in 5 years is depending on the extent of capacity building of local organizations such as the government extension sector and academic institutes.

In addition, the project has completed three research papers and seven research papers are going to be published. Moreover, the project team has developed training manuals and videos based on these interventions. These will be integrated into curriculum of undergraduate and masters in agriculture based academic programs. CABI will also integrate these publications in their future projects focused on vegetables and may develop collaborations with other potential private extension organisations working within Pakistan for wider extension of these approaches and intervention packages for mass adoption.

---

### 8.2 Capacity impacts – now and in 5 years

Throughout project life, project team trained 343 direct beneficiaries vegetable farmers (172 men, 135 women and 36 youth), 1166 indirect beneficiary farmers (779 men, 291 women and 96 youth) across the three vegetable value chains in the areas of nursery production, crop management, harvest and postharvest, marketing and community engagement. Moreover, 67 personnel from all project partners including 45 men and 22 women participated in project activities. Peer to peer learning was noticed in the project village, leading to larger adoption of best practice interventions. Therefore, it is expected that

technology spill over through SVVCP direct beneficiary farmers and farmer leaders will continue to happen in the next 5 years in the surrounding villages. However, for scaling out at large scale warrants capacity building of public and private extension providers in the Punjab and Sindh provinces.

NARC (National Agriculture Research Centre) team has incorporated whole family, value chain approaches in their research and training programs. WADO (Women Agriculture Development Organization) and Engro Foundation developed awareness about value chain approach and supported community to adopt the value chain approach. UAF production, postharvest and marketing teams have incorporated value chain approach in their teaching curriculums. Through this project, CABI team has developed strong value chain development skills. It is expected that in the future many researchers, extension staff and government officers will embrace the value chain approach, however, external funding may need to support value chain programs to demonstrate benefits of these approaches on sustainable basis before it is adopted by public and private extension systems in Pakistan.

---

## **8.3 Community impacts – now and in 5 years**

The project employed community-based approaches to engage the local farming community in project activities. Significant impacts of project activities have been recorded on the community.

### **8.3.1 Economic impacts**

The onion village Ibrahim Shah in Sindh has a total of 250 families and among them 201 families have grown onion crops in 2021-2022 season. The project team conducted individual surveys of 196 male farmers growing onion, out of which 194 farmers adopted the project interventions, recording an adoption rate of more than 98%. The average volume produced by each onion farmer adopting the interventions was 26.5 tonnes. A total of 5140 tonnes of onion were produced through SVVCP interventions and most of the onion was exported due to the market desired quality. The average price farmers received from their intervention onion was 67% higher than the market price. Best practice postharvest interventions have created a significant role for women in onion value chains leading to improved employment opportunities with 20 percent higher wages. Due to the increased demand by exporters for the quality onion featured with long storage life and demonstration of effective farmer-to-farmers scaling out and farmer leaders, it is expecting at least 1000 onion farmers will adopt the interventions and onion export volume from Pakistan will increase significantly in 5 years.

The tomato consignments demonstrated smallholder farmers received a 28 per cent price premium comparing to traditional practices. The nursery business conducted by female members of the foundation and apprentice groups sold seedlings at a gross margin of PKR 0.8/seedling, generating an increase in household revenue of approximately PKR 15,200. It is expected that at least 200 tomato farmers from the same village as well as neighbouring villages will pick up this best practice in 5 years based on successful demonstration of farmer leaders, farmer-to-farmer learning and collective work.

The general adoption survey of target two potato villages in 2022 indicates 80% farmers increased their profit due to these interventions. The labour (men and women) also increases their daily wages PKR 100 due to better sorting and grading. It is expected that 500 more potato farmers will adopt value chain interventions to improve their income in 5 years due to positive demonstration of farmer leaders, farmer-to-farmer scaling out and collective marketing.



### 8.3.2 Social impacts

The project has had a positive impact on women farmers and laborers, as it has provided them with additional opportunities and benefits from participating in value chain activities, such as increased income, improved community support, better social networking, and self-esteem. The project has had a greater impact on families of lower economic status, as the increased family income has been utilized for healthcare, education, and further farming activities.

The whole-family approach facilitated women's participation and improved the trust and confidence of male members in understanding and recognizing the role of women. Farmers, particularly women farmers, have acquired valuable skills related to nursery production, harvest and post-harvest management of tomato, potato and onion, sorting, grading, and picking, which has led to transformation in these value chain production practices.

The emergence of women's groups, leadership roles, and collaboration within smallholder villages, as well as with other villages, has significantly improved their social networks. Joint decision-making as a family was improved in almost all aspects of household and farm decisions. Women's access to information, skills, and assets were increased, leading to changed behaviour among farming communities and improved development outcomes.

### 8.3.3 Environmental impacts

The project postharvest interventions decreased the wastage of vegetable crops along the chains which may contribute to a positive impact on the environment. SVVCP best practice interventions such as raising seedlings in insect-proof tunnels, Trichogramma cards to control sucking insects through biological control method and minimize the pesticides usage, Split application of bacteria-coated nitrogen and phosphorus fertilizers (i.e. Nutraful; Jaffer Agro Services), use of bio-fungicide (i.e. Biomagic) and seed treatment method suggested by SVVCP production have significantly reduced the amount of chemical use, improved soil microfauna and consequently soil and environmental health.

---

## 8.4 Communication and dissemination activities

All the research work done in SVVCP was incorporated into trainings and communication material for wider audience including farmers and extension workers. 69 farmer trainings and 12 farmer field days were conducted throughout project life for dissemination of the project interventions. 11 'best practice' manuals (01 on nursery; 04 on production technology, 04 on postharvest and 02 on marketing) were developed to be used in these trainings and field days. Moreover, pictorial illustrations on onion thrips; green chili chutney, vegetable nursery and tomato postharvest handling were also developed for wider dissemination. 05 Videos (02 on walking the chain to promote female knowledge concerning marketing; 02 on postharvest handling of tomato and potato and 01 on green chili chutney) were also developed for farmers. One video on project approaches, impact and three videos for women empowerment were produced for target audiences that include value chain actors, public and private organizations, NGOs, and donor agencies.

05 research papers were published to share the knowledge generated in SVVCP research activities in national and international peer review research journals on production system, postharvest handling, value chain development and organisational collaboration. SVVCP team members participated in 04 national and international conferences in Australia, Malaysia and Pakistan to share project findings.

SVVCP project team also participated in 03 Horticulture Expos to extend the project achievements with local industry. 10 blogs were also published on CABI blog website (<https://blog.cabi.org/>) to share the project approaches and achievements with a wider audience.

Quarterly SVVCP newsletters, monthly highlight reports, and quarterly annual reports were developed and shared for the project updates with project partners and stakeholders.

---

## 9 Conclusions and recommendations

---

### 9.1 Conclusions

The SVVCP project successfully achieved the objectives pertaining to strengthening the value chains of the three vegetable crops in Pakistan using a community-based value chain approach. The attitude of the farmers in the target villages have shifted from production driven to market-led, resulting in the improvement of product quality and production efficiency and significant increases in small household income and crop gross margins per acre. The whole family approach has increased the engagement of women and youth in value chain activities. The daily wages of female labour have significantly increased.

Based on the abovementioned statements it can be concluded that

- The SVVCP project has successfully achieved most of its objectives and successfully demonstrated that project approaches and interventions improved the engagement of smallholder farmers including women and youth in vegetable value chains and improve their livelihood.
- The key factor driving these outcomes is the value chain approach which focuses on understanding what consumers value, then learning how to create, deliver and share that value. For all three crops, interventions revolved around creating consumer value and/or improving efficiency by reducing waste. However, the value chain approach can't be applied successfully at rural community level unless it is integrated with participatory and whole family approach, supported by a multidisciplinary project team.

The following lessons have been learned:

- The value chain approach, facilitated by an integrated multi-disciplinary team, can deliver sustainable community-wide benefits for smallholder farmers and women.
- The value chain approach is more effective when implemented by a smaller number of aggressive and committed farmers.
- Smallholder farmers may or may not be equitably rewarded for the consumer value they create if they continue to sell through wholesale markets.
- The scaling out of the value chain approach depends on the development of the capacity of government and private extension providers to fill in the role of multidisciplinary facilitation team.

---

### 9.2 Recommendations

The key recommendations include:

- Starting with a small number of farmers who are aggressive and willing to change. The project started with small (2 to 5 farmers) who are progressive and motivated and committed rather than training many farmers.
- Frequent visits and communication with farmers by the research team to discuss issues and challenges regarding the adoption of interventions, a way to build trust relationships.
- Walk the chain with farmers, an effective way to create farmers' incentive in adoption.
- Conduct consignments to demonstrate the financial outcome of interventions. Most farmers are not willing to take risks of trying new practices unless they observe the benefit from neighbouring farmers. Evidence speaks louder than words.

- The adoption of 'best practice' interventions outside the target groups are not at a large scale. So, there is a research question to address how to scale out SVVCP interventions. A big challenge facing Pakistan Extension sector is its capacity to form a multi-disciplinary team as most of their staff are experts in crop production and there are no social and marketing experts. Research is needed on the involvement of multiple wings of provincial agriculture departments and potential private agricultural extension services in Punjab and Sindh to strengthen the scaling out process.
- **Development and validation of Value Chain/Whole-of-Family/PAR model for small holder value chain and community development**  
While the project has successfully established Value Chain/Whole-of-Family/PAR model for small holder value chain and community development, it was recommended in the end of project review report that a future project further enhance this model to adapt and demonstrate the models' applicability for scaling out and sustainability.

---

## 10 References

---

### 10.1 References cited in report

Enter text N/A

---

### 10.2 List of publications produced by project

Sr.#	Publications
1	Mazhar, M. S., Bajwa, B. E., McEvilly, G., Palaniappan, G., & Kazmi, M. R. (2019). Improving Vegetable Value Chains in Pakistan for Sustainable Livelihood of Farming Communities. <i>Journal of Environmental and Agricultural Sciences</i> , 18, 1-9.
2	Panhwar, A. A., Qureshi K., Sheikh S. A., Soomro, A. A., & Soomro, S. A. (2020). Physico-Chemical Properties of onion Powder as Affected by Drying Methods. <i>Sindh University Research Journal (science Series) University of Sindh, Jamshoro</i> . vol, 52 (04) pp 319-322
3	Sheikh, F.A., Sheikh S. A, Sun, X., & Panhwar, A. A., (2020). Customer Responses in Tomato and Onion Value Addition: A Success case Khairpur Mirs Sindh-Pakistan. <i>International Journal of Case Studies</i> . vol (9)3/3/2020. pp 1- 8
4	Sheikh, F.A., Sheikh S. A, Panhwar, A. A., & Hullio, H. H., (2020). Customer Responses in Chili Value Addition: A Success Story of Khairpur Mirs Sindh-Pakistan. <i>international journal of Case Studies</i> . vol (9). pp 83- 87
5	Riaz, R., Jawaid, A., Bajwa, B. E., & Asif, M. (2020). Assessing Food Safety and Quality Compliance: An Evidence from Vegetable Industry. <i>The Third International Tropical Agriculture Conference (TROPAG 2019)</i> . <a href="https://doi.org/10.3390/proceedings2019036042">https://doi.org/10.3390/proceedings2019036042</a>
6	Sarfraz, S., Hasan, M. U., Malik, A. U., Anwar, R., & Riaz, R. (2020). Low Cost Glad Wrap Film Packaging Delays Postharvest Senescence and Maintains Fruit Quality of Green Chillies. <i>The Third International Tropical Agriculture Conference (TROPAG 2019)</i> . <a href="https://doi.org/10.3390/proceedings2019036043">https://doi.org/10.3390/proceedings2019036043</a>
7	Ziaf, K., Haider, M. W., Malik, A. U., Anwar, R., & Riaz, R. (2020). Optimizing Planting Method and Fertilizer Application Rate for Producing High Quality Nursery of Onion cv. Phulkara. <i>The Third International Tropical Agriculture Conference (TROPAG 2019)</i> . <a href="https://doi.org/10.3390/proceedings2019036084">https://doi.org/10.3390/proceedings2019036084</a>

8	<p>Rehman, H.M., Palaniappan, G., Bajwa, B. &amp; Anwar, Z. (2020). Can Strong Social Stigma Weaken Women Participation in Farming?. Conference/workshop paper. Inclusive business, innovation, society and economic growth. p 81</p> <p><a href="https://publishing.globalcsrc.org/proceedings/">https://publishing.globalcsrc.org/proceedings/</a></p>
9	<p>Anwar, R., Ishtiaq, A., Malik, A.U., Hasan, M.U., Ziaf, K. &amp; Rehman, H.M. (2020). Evaluation Of Storage Potential Of Commercial Tomato Cultivars.IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 92.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>
10	<p>Malik, A.U., Ziaf, K., Anwar, R., Hasan, M.U., Haider, M.W. &amp; Riaz, R. (2020). Value Chain Approach For Improving Market Opportunities For Small Land Holding Vegetable Growers: A Case Study Of Pakistan. IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 5.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>
11	<p>Amin, H., Jahangir, M.M., Malik, A.U., Anwar, R., Hasan, M.U., Ziaf, K. &amp; Asad, H.U. (2020). Optimization of Curing Technique for Long Term Storage of Summer Harvested Onion. IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 152.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>
12	<p>Anwar, R., Fahim, M., Malik, A.U., Hasan, M.U., Ziaf, K. &amp; Rehman, H.M. (2020). Effect Of Modified Atmosphere Packaging On Fruit Quality Of Fresh Tomatoes. IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 01.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>
13	<p>Haider, M.W., Ziaf, K., Malik, A.U., Anwar, R., Ayyub, C.M. &amp; Ghani, M.A. (2020). Determining The Set Production Potential Of Four Cultivars And Comparison Of Phosphatic Fertilizers In Onion. IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 89.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>
14	<p>Hasan, M.U., Malik, A.U., Anwar, R., Rehman, R.N.U., Khan, A.S., Asad, H.U. &amp; Ziaf, K. (2020). Recent Developments in Extending Storage and Shelf Life of Green Chillies. IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 110.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>

15	<p>Kamran, M., Malik, A.U., Hasan, M.U., Ayyub, C.M., Anwar, R. &amp; Ziaf, K. (2020). Assessment Of Storage Potential To Extend The Marketable Window Of Potato. IV International Horticulture Conference, University of The Punjab, Lahore, Pakistan. p 123.</p> <p><a href="https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf">https://www.pshsciences.org/wp-content/uploads/2020/09/IHC2020_Abstracts.pdf</a></p>
16	<p>Hasan, M.U., Malik, A.U., Anwar, R., Khan, A.S., Haider, M.W., R. Riaz, Ali, S., Rehman, R.N.U., Ziaf, K. (2021). Postharvest Aloe Vera Gel Coating Application Maintains The Quality Of Harvested Green Chilies During Cold Storage Journal Of Food Biochemistry.</p> <p><a href="https://onlinelibrary.wiley.com/doi/full/10.1111/jfbc.13682">https://onlinelibrary.wiley.com/doi/full/10.1111/jfbc.13682</a></p>
17	<p>Malik, A.U., Hasan, M.U., Anwar, R., Ziaf, K. Riaz, R. (2021). Improving Market Opportunities for Small Land Holding Tomato Growers by Addressing Post Harvest Value Chain Issues: A Case Study of Punjab-Pakistan. Pakistan Society for Horticultural Science and Institute of Horticultural Science, University of Agriculture, Faisalabad.</p> <p><a href="http://www.pshsciences.org/wp-content/uploads/2021/02/Abstract-Book.pdf">http://www.pshsciences.org/wp-content/uploads/2021/02/Abstract-Book.pdf</a></p>
18	<p>Ziaf, K., Haider, M.W., Malik, A.U., Anwar, R., Riaz, R., Asif, M., Bajwa, B.E., Cheema, K.L. (2021). Determining Set Production Potential of Three Cultivars and Comparison of Phosphatic Fertilizers in Onion. International Horticulture e-Conference. Pakistan Society for Horticultural Science, Institute of Horticultural Science, University of Agriculture, Faisalabad</p> <p><a href="http://www.pshsciences.org/wp-content/uploads/2021/02/Abstract-Book.pdf">http://www.pshsciences.org/wp-content/uploads/2021/02/Abstract-Book.pdf</a></p>
19	<p>Hasan, M.U., Malik, A.U., Wang,Q., Anwar, R., Khan, A.S., Maryam, A. (2021) Response of 1-MCP Smart Card Technology in Delaying Postharvest Senescence and Maintaining Overall Quality of Green Chilies. Pakistan Society for Horticultural Science and Institute of Horticultural Science, University of Agriculture, Faisalabad</p> <p><a href="http://www.pshsciences.org/wp-content/uploads/2021/02/Abstract-Book.pdf">http://www.pshsciences.org/wp-content/uploads/2021/02/Abstract-Book.pdf</a></p>
20	<p>Hasan, M.U., Anwar, R., Rehman, H.M., Ziaf, K. (2021) Postharvest Management Of Potato. CABI e-book. DOI: 10.1079/9781800623811.0000</p>
21	<p>Anwar, R., Hasan, M.U., Ziaf, K., Rehman, R.N.U., Riaz, R. (2021) Postharvest Technology of Tomato. CABI e-book. DOI:10.1079/9781800623842.0000</p>
22	<p>Rehman, R.N.U., Anwar, R., Hasan, M.U., Ziaf, K. (2021). Postharvest Technology of Green Chilies. CABI e-book. DOI: 10.1079/9781800624023.0000</p>

23	Jahangir, M.M., Anwar, R., Hasan, M.U., Ziaf, K., Asad, H.U. (2021). Postharvest Technology of Onions. CABI e-book. DOI: 10.1079/9781800623873.0000
24	Ziaf, K., Haider, M.W., Riaz, R., Usman, M. (2021). Nursery Raising Protocol for Tomato, Chilies and Onion. CABI e-book. DOI: 10.1079/9781800623903.0000
25	Ziaf, K., Haider, M.W., Anwar, R., Riaz, R. (2021). Production Technology of Tomatoes. CABI e-book. DOI: 10.1079/9781800623934 .0000
26	Ziaf, K., Haider, M.W., Anwar, R., Riaz, R. (2021). Production Technology of Tomatoes. CABI e-book. DOI: 10.1079/9781800623934 .0000
27	Ziaf, K., Haider, M.W., Anwar, R., Rehman, H. M., Hasan, M.U., Ayyub, C.M.,(2021). Production Technology of Potatoes. CABI e-book. DOI: 10.1079/9781800623965.0000
28	Ziaf, K., Anwar, R., Haider, M.W., Asad, H.U., Sher, M.U., Hasan, M.U. (2021). Production Technology of Onions. CABI e-book
29	Ziaf, K., (2021) Commercial Testing of UAF-Gro (An indigenous Soilless substrate developed by IHS-UAF) for Tomato Nursery Production at farmer fields HortiMag  <a href="http://www.pshsciences.org/wp-content/uploads/2022/07/HortiMag2021_2.pdf">www.pshsciences.org/wp-content/uploads/2022/07/HortiMag2021_2.pdf</a>
30	Taj, S., Palaniappan, G., & Anwar, Z. (2020). Linkages for life: Assessing Tomato Value Chain Pathways and Opportunities for Better Livelihoods of Marginal and Vulnerable Groups in Pakistan. The Third International Tropical Agriculture Conference (TROPAG 2019). <a href="https://doi.org/10.3390/proceedings2019036184">https://doi.org/10.3390/proceedings2019036184</a> . <a href="https://www.mdpi.com/2504-3900/36/1/184">https://www.mdpi.com/2504-3900/36/1/184</a>
31	Hayder, A., Asad, H. U., Panhwar, A. A., Sun, X., Palaniappan, G., Asif, M. and Rajput, I. S. (2022) A Case Study on Value Addition Business led by Rural Women in District Khairpur, Pakistan. International Horticulture Conference 2023, Pakistan Society of Horticultural Sciences  <a href="https://www.pshsciences.org/event/ihc2022/">https://www.pshsciences.org/event/ihc2022/</a>
32	Asad, H., Hayder, A., Asif, M., Sun, X., Collins, R. J., Dunne, A. J., Palaniappan, G., & Rajput, I. S. (2022). Empowering Smallholder Onion Farmers through a Value Chain Approach. International Horticulture Conference, Pakistan Society of Horticultural Sciences. <a href="https://www.pshsciences.org/event/ihc2022/">https://www.pshsciences.org/event/ihc2022/</a>



33	<p>Rajput, I. S., Asad, H. U., Hayder, A., Palaniappan, G., Sun, X. and Asif, M. (2022). A Whole Family Approach Improves Gender Inclusion in Onion Value Chain in Rural Sindh. International Horticulture Conference, Pakistan Society of Horticultural Sciences.</p> <p><a href="https://www.pshsciences.org/event/ihc2022/">https://www.pshsciences.org/event/ihc2022/</a></p>
34	<p>Rehman, H. M., Ishaq, R., Asif, M, Ahmad, Q, Sun, X., &amp; Palaniappan, G. (2022). Does Value Chain Approach Enhance the Profitability of Small Potato Farmers in Punjab?. International Horticulture Conference, Pakistan Society of Horticultural Sciences.</p> <p><a href="https://www.pshsciences.org/event/ihc2022/">https://www.pshsciences.org/event/ihc2022/</a></p>
35	<p>Akhter, W., Taj, S., Anwar, Z., Afridi, G. S., Palaniappan, G. &amp; Zahid ullah (2022). Economic Evaluation of Tomato Sole and Tomato Onion Intercropping Systems of Smallholders in District Muzaffargarh, Pakistan. Proceedings of Pakistan Science Academy.</p> <p><a href="https://www.paspk.org/proceeding/proc-of-the-pas-8-58-no-2/">https://www.paspk.org/proceeding/proc-of-the-pas-8-58-no-2/</a>.</p>
36	<p>Haider, M. W., Ziaf, K., Anwar, R., Malik, A. U., Jahangir, M. M., Riaz, R., &amp; Ayyub, C. M. (2022). Impact of Seed Sources, Genotypes and Fertilizer Sources on Onion Set Production Potential. Journal of Environmental &amp; Agricultural Sciences (JEAS). Volume 24, Issue 1 &amp; 2</p>
37	<p>Ziaf, K., Haider, M. W., Anwar, R., Riaz, R., Ayyub, C. M, Malik, A. U., Naveed, M., Mushtaq, M., Hasan, M.U. (2022). Amino Acid And Microbial Enriched Compost With Different Fertilization Regimes Modulates Yield, Quality And Reduces Nitrogen Requirements Of Potato Crop In Sandy Loam Soil. The Journal of Animal and Plant Sciences</p> <p>(SUBMITTED &amp; UNDER REVIEW)</p>
38	<p>Malik, A. U., Anwar, R., Jahangir, M. M., Ziaf, K., Hasan, M.U., Amin, H., Asad, H., Naqvi, A., Asif., Bajwa, B. E. (2022). Onion Value Chain Improvement Through Postharvest Research And Development: A Case Study With Small-Scale Onion Growers In Sindh, Pakistan. Pakistan Journal of Agricultural Science</p> <p>(SUBMITTED &amp; UNDER REVIEW)</p>

### 10.3 List of Published Blogs

Sr.#	Blogs Title
1	<a href="#">Vegetable project in Pakistan build capacity of agriculture extension staff on value chain approach in Punjab and Sindh</a>
2	<a href="#">Onion value chain interventions increase incomes for growers in Sindh province, Pakistan</a>
3	<a href="#">Onion farmers embrace value chain approach and ‘best practice’ interventions in rural Sindh</a>
4	<a href="#">Better livelihoods sought for smallholder onion farmers</a>
5	<a href="#">Enabling the disadvantaged: ACIAR vegetable value chain project helps small onion farmers in Tando Allahyar, Sindh, earn higher profits</a>
6	<a href="#">Boosting socio-economic gender equity for smallholder potato farmers in Pakistan</a>
7	<a href="#">Women and youth play key role in nutritional aspects of Pakistan’s potato value chain</a>
8	<a href="#">Farmer praises CABI’s postharvest training to help boost Pakistan’s smallholder tomato production</a>
9	<a href="#">Repelling poverty through tomato nursery seedling enterprise</a>
10	<a href="#">Farmers learn advanced nursery raising techniques to strengthen Pakistan’s vegetable value chains</a>

---

# 11 Appendixes

---

## 11.1 Appendix (Annual reports)

### Annual Report 2018-19

Appendix 1: May 2018 Social Science Team trip report “village visits to assess community capacity”

Appendix 2: Criteria developed for village and farmer selection “Village profiling in Punjab” & Village profiling in Sindh

Appendix 3: Criteria developed for village and farmer selection “Village profiling in Sindh

Appendix 4: Gender Roles in Vegetable Value Chains & Training Needs Assessment Punjab

Appendix 5: Gender Roles in Vegetable Value Chains & Training Needs Assessment Sindh

Appendix 6: Desktop study (review of literatures), role of women in vegetables value chains

Appendix 7: Participatory Method Social Network Analysis in “Aug-Sep 2018 Social Science Team trip report”

Appendix 8: Report of walk the chain activity in Sindh

Appendix 9: Report of walk the chain activity in Punjab

Appendix 10: Report on the cost of Production analysis of Potato, Tomato, and Onions in Punjab-Pakistan

Appendix 11: Case study report on mango pickle

Appendix 12: Potato value adding products survey

Appendix 13: Chilies value adding products survey

Appendix 14: Quality Standards of targeted crops

Appendix 15: Quality and Loss Assessment report

Appendix 16: Potato trial consignment report

Appendix 17: Consumer evaluation on SAU value adding products

Appendix 18: Brochure (Onion), Urdu

Appendix 19: Brochure (Postharvest and production), Urdu

Appendix 20: Brochure (Potato), Urdu

Appendix 21: Brochure (Tomato), Urdu

Appendix 22: Report on diagnostic survey of the pathological issues

Appendix 23: Production experiments of UAF (July 01-Dec. 31, 2018)

Appendix 24: Postharvest experiments, UAF

Appendix 25: Brochure (Green Chilies), Sindhi

Appendix 26: Brochure (Green Chilies), Urdu

Appendix 27 Desktop study value chain analysis and literature review

Appendix 28: Market survey of value addition products in retail stores

**Annual report 2019-20**

Appendix 1: Gender GAP Report - Sindh

Appendix 2: Gender Gap report - Punjab

Appendix 3.1: Training Evaluation Report on potato Diseases and their Treatment- Okara

Appendix 3.2: Training Evaluation Report on potato Diseases and their Treatment

Appendix 3.3: Training Evaluation Report on Tomato Nursery Preparation and Tomato Production

Appendix 4: Training Evaluation Report-Sindh Value Addition training

Appendix 5: Rapid Rural Appraisal - all vegetable value chains

Appendix 6: Selection of farmers willing to work together on nursery production

Appendix 7: Potato consignment report/Potato walk the chain activity report

Appendix 8: Training report on marketing and record keeping in Sindh

Appendix 9: A Pre and Post Assessment of Farmer walk the onion value chain

Appendix 10: A pre and post analysis of farmer's perceptions on potato walk the chain activity

Appendix 11: Farmers Field Day report

Appendix 12: Capacity Building of researchers

Appendix 13: Training Modules related to Potato, tomato value chains

Appendix 14: Training Modules related to onion and green chili value chains

Appendix 15: Videos message for farmer in covid19 situation

Appendix 16: Evidence Report Tomato Nursery

Appendix 17: Evidence Report Potato Health management

Appendix 18: Evidence Report Comparison of yield between two generations and fertilizer application methods in potato cv. Musica

Appendix 19: Evidence Report 5 Evaluation of fungicide coated seed potato and its comparison with farmer's practice for the common scab control

Appendix 20: Evidence Report - Onion Curing

Appendix 21: Evidence Report - Green Chilies LDPE

Appendix 22: Evidence Report Value addition green chili chutney

Appendix 23: Evidence Report Quality Standards

Appendix 24: Evidence Report Onion trial consignment

Appendix 25: Evidence Report Effect of seed generation and gypsum application on potato

Appendix 26: Feasibility to produce nursery by plug trays using SVVCP media

Appendix 27: Quality standards of four targeted crops

Appendix 28: Potato quality and loss assessment report

Appendix 29: Green chilies quality and loss assessment report

Appendix 30: Onion quality and loss assessment report

Appendix 31: Quality and loss assessment of tomato fields in target villages could only be partially completed due to Covid-19 pandemic.

Appendix 32: Preliminary survey report on onion nursery businesses in Sindh

Appendix 33: Preliminary tomato nursery business Survey in Punjab

Appendix 34: Market survey for Identification of buyers for dehydrated onion

Appendix 35: Report on analysis on monthly supplies of vegetables in various markets of Punjab, Pakistan

Appendix 36: A report on market research survey of vegetable value added products in district Khairpur and Sukkur

Appendix 37: Capacity Building of researchers-Potato value chain

Appendix 38: Report of Participation of SVVCP Marketing Team in Pakistan Horti Expo 2020, Lahore

Appendix 39: On-farm trials at Okara

Appendix 40: Report on exploring storage potential of commercial tomato varieties. Small interventions for tomato for better market life and profitability

Appendix 41. Optimization of curing technique for onion

Appendix 42. Storage potential of commercial onion varieties

Appendix 43. Green chili storage in LDPE

Appendix 44 Tomato storage in LDPE

Appendix 45. Demo plots for nursery seedlings-Tomato

Appendix 46. Capacity building-Researchers, partners stakeholder-Tomato nursery

Appendix 47: Onion PFTS reports

Appendix 48. Onion PFTS Report

Appendix 49. Onion FPTS Presentation

Appendix 50. Potato PFTS Report

Appendix 51. Potato FPTS Presentation

Appendix 52. Tomato PFTS Report and Quality loss assessment

Appendix 53. Demonstration of seed sorting and treatment before sowing-potato

Appendix 54. Soil and water analysis – potato

Appendix 55. Training on marketing and record Keeping in Muzaffargarh

Appendix 56. Training on Entrepreneurship and Record Keeping-Okara  
Appendix 57. Standardization of local growing media for nursery production  
Appendix 58. Nursery raising by conventional and modern method-Tomato  
Appendix 59. Disease rating in nursery raised by two methods-Tomato  
Appendix 60. SVVCP linking with grants, technology transfer with BCI & VCTAT

**Annual report 2020-21**

Appendix 1: Tomato Value Chain Activities Progress Report  
Appendix 2: Tomato Value Activities Progress Report  
Appendix 3: Onion Value Chain Activities Progress Report  
Appendix 4: Potato Value Chain Activities Progress Report  
Appendix 5: Progress of Project KPIs for Three Value Chains  
Appendix 6: Publications List  
Appendix 7: Community Engagement Capacity Building  
Appendix 8: Gender Inclusion and Nutrition Awareness

**Annual report 2021-22**

Appendix 05: Tomato Flagship Initiative Progress Report #3  
Appendix 06: Tomato Flagship Initiative Progress Report #4  
Appendix 07: Potato value chain activities progress report (2021-22)  
Appendix 08: Gender & Youth Evaluation Report 2021  
Appendix 09: Evaluation report- Onion VC adoption and Scaling activities 2021  
Appendix 10: Farmers Planning meeting Report  
Appendix 11: Irrigation and nutrient Management Training  
Appendix 12: Farmer leader training Report  
Appendix 13: Farmer Field day (Market linkages) report  
Appendix 14: Farmers Product Promotional market visit Report  
Appendix 15: Onion farmers trainings Report  
Appendix 16: Value Chain training report of Agri. Extension Sindh Staff  
Appendix 17: Farmer Field day report  
Appendix 18: Onion VC team participation Report in IHC2022  
Appendix 19: Onion consignments Report 2021-22

Appendix 20: Value addition report 2021-22

Appendix 21: General adoption Report- Onion Value Chain 2021-22

Appendix 22: Gender Evaluation Report in Onion Value Chain

Appendix 23: Understanding, Integrating and Mainstreaming Gender into Vegetable Value Chains in Pakistan: An ex- post analysis of SVVCP

## 11.2 Appendix - List of active project members

Sr.#	Name	Project Role
<b>Pakistan Team</b>		
1.	Dr. Babar Ehsan Bajwa	Project Leader
2.	Mr. Muhammad Asif	Project Manager
3.	Mr. Muhammad Danish	M&E Coordinator
4.	Mr. Zeeshan Butt	Finance/Admin Coordinator
5.	Dr. Rehan Riaz	Research officer vegetable value chain (Tomato-Punjab)
6.	Dr. Habat Ullah Asad	Research officer vegetable value chain (Onion-Sindh)
7.	Mr. Azeem Hayder Naqvi	Research Officer Marketing (Onion-Sindh)
8.	Dr. Hafiz Mahmood ur Rehman	Research officer vegetable value chain (Potato-Punjab)
9.	Mr. Qadeer Ahmad	Research officer Marketing (Tomato, Potato-Punjab)
10.	Ms. Narjis Fatima	Social Mobilizer (Tomato -Punjab)
11.	Ms. Rahila Ishaq	Social Mobilizer (Potato -Punjab)
12.	Ms. Iqra Sultan Rajput	Social Mobilizer (Onion-Sindh)
13.	Dr. Muhammad Zubair	Social Science Specialist
14.	Dr. Sajida Taj	Social Scientist

15.	Dr Khurram Ziaf	Vegetable Production Expert
16.	Dr. Raheel Anwar	Postharvest horticulture specialist
17.	Dr. Hamad Badar	Agribusiness / Rural Development Expert
18.	Dr. Aasia Akbar Panhwar	Product Development Specialist (Sindh)
19.	Mr. Abdul Razzaq	Agriculture Extension Punjab
20.	Mr. Sana Ullah Solangi	Production Horticulture Specialist (Sindh)
21.	Mr. Mir Hajan Talpur	Agriculture Extension Sindh
22.	Ms. Zahida Parveen	Social Mobilisation Specialist (Sindh)
23.	Mr. Awais Amar	Social Mobilisation Specialist (Punjab)
24.	Ms. Shafaq	Female Social Mobilizer (Punjab)
<b>Australian Team</b>		
25.	Dr. Tony Dunne	Consultant, Value Chain Specialist
26.	Emeritus Prof. Ray Collins	Consultant, Agribusiness Specialist
27.	Dr. Gomathy Palaniappan	Gender Specialist
28.	Dr. Tim Sun	Teams Coordinator

### 11.3 Appendix - Student Completed Research Work & Thesis under SVVCP Project.

Sr.#	Student Name	Thesis Title	Institution & year (thesis submission)
1	Kainat Qureshi	Physico-Chemical Properties of Onion Powder as Affected by Drying Methods	SAU 2018
2	Rabia baloch	Effect of Different Packaging Materials on Quality Attributes of The Dried Green Chilli Powder	SAU 2019
3	Mr. Mudassar Khan	Effect of organically amended growing media on growth and development of hot pepper plant	UAF 2019



4	Ms. Samia Sarfraz	Effect of modified atmosphere packaging on storage life and quality of green chillies.	UAF 2019
5	Ms. Hafiza Hadiqa Anum	Effect of pre-storage treatment on shelf life and Disease management of chilli.	UAF 2019
6	Mr. Qamar Rasheed	Effect of pre-storage application of chitosan on storage life and quality of green chillies	UAF 2019
7	Marvi Waheed	Development of Technology of Different Varieties of Green Chillies Powder Production and its Nutritional Characteristics	SAU 2020
8	Ms. Atiqa Ishtiaq	Evaluation of storage potential of commercial tomato cultivars	UAF 2020
9	Mr. Maaz Fahim	Effect of low-density polyethylene film packaging on storage quality of fresh tomatoes	UAF 2020
10	Mr. Muhammad Kamran	Storage potential of important commercial potato ( <i>solanum tuberosum</i> L.genotypes available in Pakisatn.	UAF 2020
11	Ms. Hira Amin	Optimization of curing protocol and last irrigation schedule for quality management of Onion during storage.	UAF 2020
12	Mr. Muhammad Adeel	The comparative evaluation of growth and yield potential of various potato genotypes in response to Isabion application	UAF 2020
13	Mr. Mubashir Mushtaq	Potato growth, yield and quality in response to bio-stimulants, nitrogen and phosphorus fertilization	UAF 2020
14	Mr. Hammad Khalid	Comparative evaluation of PSB coated fertilizers and nitrogen applied to four potato genotypes	UAF 2020

15	Mr. Tahreem Shafiq	Developing optimal soilless growing substrate for healthy tomato nursery production	UAF 2020
16	Mr. Muhammad Anees Arif	Evaluating the potential of 1-MCP card technology for extending shelf life maintaining quality of tomato during ambient storage	UAF 2021
17	Mr. Muhammad Abdullah Aziz	Yield and quality response of potato to split application of nitrogen and phosphorus fertilizers	UAF 2021
18	Mr. Haji Muhammad Khan	Yield and related attributes of different potato varieties in response to phosphorus dose supplied through nitrophos	UAF 2021
19	Mr. Hafiz Muhammad Mueen Aslam	Effect of phosphorus dose, micronutrients and thiourea on growth, yield and quality of different varieties of potato	UAF 2021
20	Ms. Arfa Jawaid	Consumers attitude and purchase intentions towards vegetable value-added products in Pakistan	UAF 2021
SAU = Sindh Agriculture University, Tandojam, UAF = University of Agriculture, Faisalabad			