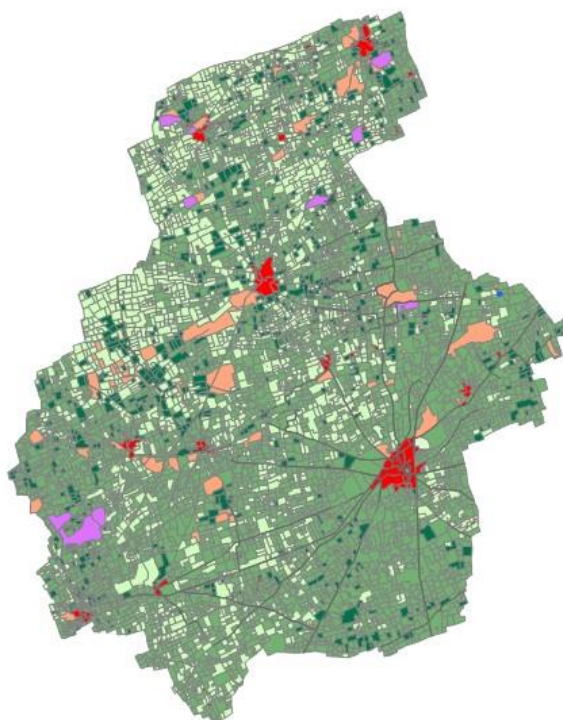


Cluster Agricultural Competitiveness Plan (CACP)

Watershed Cluster Ladnun, Nagaur
Rajasthan Agricultural Competitiveness Project (RACP)



Theme: Watershed, Block- Ladnun, District – Nagaur

Prepared by:

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Preface

The World Bank has approved credit amounting to Rs. 832.50 crores for development of 17 clusters, each having area ranging from about 10,000 ha to 31,500 ha in eight agro-climatic zones across Rajasthan to address end to end solutions to farmer's problems in three main water regimes. These include watershed/rain-fed, surface/canal water and ground water regimes with certain specified desired selection criteria's.

The Cluster Agricultural Competitiveness Plan (CACP) is the outcome of a planning process that aims to (a) identify opportunities as well as constraints towards developing one or two or more value chains in which the community deem themselves to have a potential competitive advantage and to (b) select from a list of eligible project investments and within the funding constraints of those public investments that will enable the community to address constraints and enhance opportunities towards establishing and strengthening identified value chains. The value chains proposed would envisage addressing broad sub-sectorial issues as well as help establish specific partnership arrangements between farmer groups or Producer Companies with agribusiness companies.

The Cluster Agricultural Competitiveness Plan (CACP) comprises investments to be made on improving water use efficiency, technology transfer and provision market led advisory services for agriculture & horticulture development, livestock strengthening and management especially for small ruminants, market and value chains in the cluster.

The CACP of Ladnun Watershed Cluster in Tonk district has been prepared and an amount of Rs3446.35 lakh will be invested during the project period to make the cluster and farmers competitive so that economic level of farmers in the cluster can be uplifted. Simultaneously, as well as agricultural productivity of the cluster can be optimized.

I personally appreciate the commendable efforts by ARAVALI, Jaipur, Mr. V. S. Singh, Consultant, ARAVALI and especially Dr. V. P. Singh, Jt. Director Agriculture (Agronomy), Project Coordinators, Specialists, ABPF Consultant and line departments who contributed much towards making this comprehensive document. I also appreciate all other people who supported in many ways to prepare the CACP in a short period.

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List of Abbreviations

ABPF	Agri Business Promotional Facility
AEZ	Agro-Ecological Zones
ARAVALI	Association for Rural Advancement through Voluntary Action and Local Involvement
ARS	Agriculture Research Station
ARSS	Agriculture Research Sub Station
ATC	Adaptive Trial Centre
BPL	Below Poverty Line
CACP	Cluster Agricultural Competitive Plan
CBO	Community Based Organizations
CFC	Common Facility Centres
CIG	Common Interest Group
DLIC	District-Level Implementation Committee
EMP	Environment Management Plan
e-NAM	e-National Agriculture Market
FAQ	Fair Average Quality
FCI	Food Corporation of India
FCSC	Farmer's Common Service Centre
FIG	Farmers Interest Group
FPO/FPC	Farmer Producer Organizations/ Farmer Producer Company
GIS	Geographical Information System
GoI	Government of India
GoR	Government of Rajasthan
GSS	Gram Seva Sahkari Samiti
ICM	Integrated Crop Management
ICT	Information, Communication and Technology
IMD	Indian Metrological Department
INM	Integrated Nutrient Management
IPM	Integrated Pest Management
JV	Joint Venture
KSK	Kisan Sewa Kendra
KVSS	Kriay Vikrya Sahkari Samiti
LLW	Lady Link Worker
LSCD	Loose Stone Check Dam
MI	Micro-Irrigation
MMS	Minor Masonry Structure
MPT	Mini Percolation Tank
MSP	Minimum Support Price

MTA	Multi Task Association
MTG	Multi Task Group
NAM	National Agriculture Market
NCR	National Capital Region
NeML	NCDEX e-Markets Limited
NRSA	National Remote Sensing Agency
NSPOT	NCDEX Spot Exchange
OBC	Other Backward Cast
PC	Producers' Companies
PAD	Project Appraisal Document
PDO	Project Development Objectives
PG	Producer Group
PHM	Post-Harvest Management
PIU	Project Implementation Unit
PMU	Project Management Unit
PRA	Participatory Rural Appraisal
RACP	Rajasthan Agricultural Competitive Project
RAJHANS	Rajasthan Horticulture Nursery Society
RAJUVAS	Rajasthan University of Veterinary and Animal Sciences
RKVY	Rashtriya Krishi Vikas Yojana
RS	Remote Sensing
RSSC	Rajasthan State Seed Corporation
RTC	Rural Technology Centres
SC	Schedule Caste
SCPI	Sustainable Crop Production Intensification
SFAC	Small Farmers Agri Business Consortium
SHG	Self Help Group
SR	Small Ruminants
SRR	Seed Replacement Rate
ST	Schedule Tribe
TCS	Tata Consultancy Services
TGM	Technical Grade Material
TRA	Technical Resource Agency
UMP	Unified Market Platform
VCD	Vegetative Check Dam
WUE	Water Use Efficiency

Executive Summary

The World Bank is supporting and facilitating the Rajasthan Agriculture Competitiveness Project (RACP) by way of a credit of Rs 832.50 Cr. (166.5 USD) offered to Government of Rajasthan. This Project envisages to undertake structured interventions in 17 clusters, which are selected on the basis of water themes viz. watershed, surface water and ground water, and spread across 8 agro climatic zones of the State. The Project Development Objective (PDO) is to establish the feasibility of sustainably increasing agricultural productivity and farmers' incomes through a distinct agricultural development approach by integrating agriculture, water management, agricultural technology, farmer organizations and market innovations in selected locations across the ten agro ecological zones of the state. The Project Development Objectives aim to help farmers realise more rupees per unit of water in compensation for using fewer units of water. To achieve the PDO of the RACP, activities related to four components are to be implemented in the clusters viz. Component 1: Climate Resilient Agriculture; Component 2: Markets and Value Chains; Component 3: Farmer Organization and Capacity Building; and Component 4: Project Management, Monitoring and Learning. The Key Performance Indicators (KPIs) to assess the impact of the project are (a) reduction in water used in agriculture; (b) increase in water use efficiency in agriculture; (c) increase in agricultural productivity; (d) increase in gross margins from crops and livestock products; (e) increase in the share of producer's price in wholesale price; and (e) farmer satisfaction with project deliverables.

Ladnun cluster (Rainfed-watershed) cluster in Nagaur district has been selected under the project after several visits by the PMU coordinators; consultations with officials of the WD & SC Department Jaipur; Project Manager - WC DC, Zila Parishad (Nagaur), interactions with the local community and various value-chain actors. The area is predominantly rich in agriculture and livestock rearing. Surplus production is generally available in the area as dominant crops in the cluster include Pearl Millet, Sorghum, Green Gram, Moth Bean, & Sesamum in Kharif and Isabgol, Wheat, Barley, Gram, Mustard, Cumin in Rabi season. Though horticulture is of not much significance, Onion and Ber are among major horticulture crops of the cluster. Local and cross-breed goat population also offers potential for both goat milk and meat.

The Ladnun index catchment (watershed) cluster of RACP is located in Ladnun Block of Nagaur district, which is about 123 Kms from Nagaur district headquarters and 195 Kms from Jaipur. The Ladnun cluster comprises of five Gram Panchayats and ten villages which falls in II-A Agro-Climatic Zone (Internal Drainage Dry Zone) of Rajasthan under RACP. About 50% of farmers belong to small, marginal category and a significant number of farmers are landless farmers in the cluster. Hence, they require support for economic upliftment. The project area is characterized by comparatively low and inadequate rains (413 mm per annum), low availability of soil moisture, poor fertility and soil depth status in some areas. Poor infrastructure development, farmer's low economic status, low literacy and high incidence of migration during drought are the other major challenges in the cluster area. Total population of the cluster is 26,323 and total number of households is 4,288. Out of the total population female population is 47.81% and schedule caste (SC) population is 22.22% and 0.02% is schedule tribe (ST) population.

The total cultivated cluster area i.e. 12,434.61 ha. Out of this 8851.74 ha is rainfed and 3,582.87 ha is irrigated. Out of the total cultivated area, 24.46% land is being cultivated by small and marginal farmers. Soil in the cluster area is shallow to moderately deep, dominantly sandy loam imperfectly drained, moderate to severely eroded and almost flat. Average rainfall of the cluster is 413 mm/ anum and temperature ranges from 10°C in winter to 47°C in summer.

Green Gram is being grown in 2098 ha, Pearl Millet in 3632 ha, Sorghum in 497 ha and Sesamum in 482 ha in Kharif. In Rabi, wheat is grown in 735 ha, mustard in 425 ha and Isabgol in 1190 ha. The area under vegetables like Onion, pea and okra is in 18 Ha and those of fruit crops like Pomegranate, Lemon and ber is in 14 ha. As far as crop productivity is concerned, the crop productivity of the district in the case of Green Gram, Pearl Millet, Sesamum are less than state average and that of Sorghum is more than the state average in Kharif crops. Also in Rabi crops, the productivity of Mustard, Wheat and Barley is less than state average whereas the productivity of Gram, Isabgol, Cumin and Taramira is more than the state average.

Pearl millet and Green gram in Kharif and Isabgol in Rabi have been identified for value chain development under the project based on various value chain selection parameters like: surplus production, scope of value addition, industrial value and higher returns with less water requirement to the farmers. Ladnun cluster being mostly rain fed, naturally supports goat rearing especially for the small holder farmers. The cluster has substantial goat population (17,753) and inclination for goat farming to generate income. The goat value chain is also identified to be supported under project investments. Accordingly, activities enhancing the above potentials are proposed to be implemented in the cluster. It is presumed that success of these technologies would be replicated in the similar areas

There are five APMCs (Deedwana, Degana, Kuchaman, Merta & Nagaur) and one CWC ware house in the Nagaur district which provides marketing support to the farmers and need to be leveraged.

The crops in the cluster also face adverse climatic conditions, poor soil conditions, low and scanty rainfall, less adoption of package of practices and less seed replacement rate (SRR). The project would therefore also focus on adoption of package of practices, which would mitigate the adverse factors on crop production, seeing majority of the farmers are small and marginal and highly vulnerable to minor variations in climatic conditions.

The cluster is classified as a watershed cluster and activities related to soil and water conservation is being implemented by the Watershed Development & Soil Conservation department, while activities related to production are considered by Department of Agriculture, Horticulture and Animal Husbandry (GOR). The activities related to market and value chains will be addressed and implemented by Farmer Producer Companies with the support from the Agri-Business Promotion Facility after their formation. Community mobilization, data collection and technical support to stakeholders will be provided by field level NGOs operating in the cluster.

The cluster has 150 MTGs for agriculture & horticulture activities, 20 MTGs of goat rearer, User's Groups (UGs) are being formed as per the community based activities, 5 Multi Task Associations (MTAs) have been formed and one Farmer Producer Company (FPC) is being formed in the cluster.

The Project area was categorised as bad catchment area on the basis of information available in the land records. Based upon the catchment area, the total yield of rainfall is about 60 MCM. As per ground water study, about 6-18% of rains contribute to ground water. This means around 10.80 MCM of rainwater can contribute to ground water. The crop water requirement of Kharif crops is 10 million cum, which would be met out through in-situ moisture conservation in arable area. There is total crop water requirement of Rabi crops is 8.9 million cum. If demand side water application methods are adopted on each and every wells/tube wells, 40 to 60% of total water requirement could be saved out of total crop water requirement in Rabi season. Similarly in horticultural crops the same amount of water could be saved if micro irrigation system is adopted. 4.9 million cum water can be saved by adopting irrigation efficient methods during Rabi and for horticulture crops In normal monsoon conditions. 75.29 percent ground water can be saved by adopting micro

irrigation systems on wells and tube wells. Even In case of dry spell of monsoon one life saving irrigation can be supported through micro irrigation systems. The estimated total water requirement for human beings, animals & birds etc. is 1 million cum.

A scoring intervention-matrix consisting of parameters along with weights has been deployed for prioritisation and selection of commodities/crops for value chain intervention in the cluster. The four important parameters considered include : (A) Existing size of the crop considering cropped area, production and productivity of each crop (B) Potential for value addition (implying scope for increased value addition for local producers and processors) considering price spread until mandi as well as retail level, net profit in production, scope for processing in the state, scope in terms of extent of processing (primary, secondary & tertiary), growth in market demand (C) Risk assessment considering price volatility in the commodity (D) Others considering water requirement. On this basis Bajra, Green gram and Isabgol have been selected for value chain study and intervention. Some basic interventions for Goat value chain planned under the project are; establishment of two goat milk chilling units, a milk processing and packaging unit, and a Rural Technology Centre Horticulture development through various activities like introducing water saving techniques, promoting horticulture crops etc. has also been considered. There is a range of constraints apparently in the value chains leading to lower producers' incomes. These include multiple intermediaries; limited access to market information, limited value added processing units, inadequate capacity building initiatives for members, limited primary and secondary processing facilities, lower productivity and net yield in some crops like barley vis-à-vis wheat, poor awareness in good package of practices, limited storage and primary processing facilities etc.

To address the issues of improvement of water use of efficiency, production constraints, poor access to market management etc. following appropriate investments would be done in the project area:

1. Investment activities/heads in Climate Resilient Agriculture

A. Improvement of water use efficiency:

Since this is the index catchment (watershed) so limiting activities of Rain water management like construction of Tanka, lined nadies, agroforestry, pasture development including construction of V-ditches, over seeding of grasses etc. would be done to improve the water use efficiency and to increase the productivity of the community/ pasture / government land of the area. In addition to the above some expenditure on farmer's organizations and project management costs would also be done. The total investment on these activities would be around **Rs.1,196.34 lakh**. The works would be executed on the pattern of Mukhyamantri Jal Swamlamban Abhiyan (MJSA). The Watershed Development and Soil Conservation department is responsible to implement these activities with the support of field staff, community groups and field NGO.

B. The activities of Technology transfer and market led advisory services in:

(I) Agriculture production activities will include (i) Promotion of efficient techniques of irrigation viz. drip and mini sprinklers to increase the irrigation efficiency, improve productivity and reduce cost of production (ii) Promotion of farm mechanization to reduce the cost of production (iii) Promotion of seed production to improve the SRR and the farmer income (iv) Promotion of fodder production to reduce the gap of demand and availability of fodder for the animals (v) Introduction of ICT based extension system for the quick reach of the solutions to the beneficiaries (vi) Establishment of FCSC (feasibility of utilising infrastructure created for AH like Rural Haat will be done for utilising for FCSC)to encourage the farmer organization of cluster for their own input arrangement and facilitate the value addition and marketing of agro-produce and (viii) Capacity building of the beneficiaries to achieve the PDO. An investment of **Rs.1122.89 lakh** would be incurred on these activities.

(II) Horticulture production activities will include (i) Demonstrations on production technologies for Fruit Cultivation, (ii) Demonstrations on production technologies for vegetable cultivation including assistance on green house, assistance on shade net house, (iii) Solar Pump Program, (iv)

Post-Harvest Management (v) Horticulture Mechanization and (vi) Farmers training, Seminars, Exhibition Kisan mela etc. An investment of **Rs.592.80 lakh** would be incurred on these activities.

(III) Livestock Strengthening & Management activities will include:

(i) improve productivity (milk and weight gain) through investment in breeding, feeding and animal health services (ii) improving market access and local level small value addition (iii) supporting farmer advisory and training of the farmers, and training of existing Animal Husbandry Department's technical staff and (iv) Project management. An investment of **Rs.302.32 lacs** would be incurred.

2. Market and value chains activities include:

Market Value chain and marketing infrastructure will be developed in the cluster with the support local community three crops i.e. Green gram, Bajra, Isabgol and Goat Value chains are selected as value chain development in the cluster. Accordingly the Farmer Producer Company and individual beneficiaries would be supported through (i) institutional cost for functional support, (ii) Value chain for FPCs and capital expenditure for individual agripreneurs. Total 4 units under FPC and 4 units for individual agripreneurs can be supported under the project. A tentative investment of **Rs.232 lakh** would be incurred during the project period on these activities and cost of Goat Value chain development has been included in Livestock Strengthening and management component. The Project Management Unit (PMU) and Agriculture & AH department are responsible to implement these activities with the support of field staff, community groups, Agri-Business Promotion Consultants and field NGO.

The intervention plan in the selected commodities in the light of critical constraints may be viewed as follows:

Green gram:

Sr.no	Constraints	Action
1.	Production	
	Limited Production of processing friendly varieties- Nagauri (model) 77% yield. Others varieties less than 50%	seed production program using Raj seed /seed assistive (twin with cluster)
2.	Post-Harvest	
2.1	Moisture content of harvested pulse is high	Drying facility required at farm level by way of CFC.
2.2	High dirt content in harvested pulse.	Ensure availability of the Cleaning & Grading facility to farmers.
2.3	Mostly rain-fed crop usually resulting in harvesting of immature grain without water/critical irrigation at time of pod filling. Resulting in small-sized grain hence yield in milling is low.	Farmer training, watershed management /sprinkler irrigation, pond + drip option etc led to be considered.
2.4	4/8 quintals/acre in poor/good harvest. During good harvest, prices tend to collapse and hence storage option could help reduce distress sale.	Storage facilities for farmers as part of FCSC
3.	Processing	
3.1	Lack of awareness about special license option to source directly from farmers /FPOs.	Awareness seminars for farmers and processors
3.2	Export of imported pulses only after value addition. "Food Security Agreement" Import from Africa, Myanmar, Canada and Australia subject to import duty of 12-25%.	Advocate for reducing import duty at least during off season in Rajasthan. Alternatively, higher duty/ less or cap on quantity during surplus periods.
	Restricted stocking limits of processors deterring	Advocate higher stocking limits at least

Sr.no	Constraints	Action
	more procurement during bumper crop season.	during bumper crop periods and lifting ban from exports
3.3	Banks do not support adequate storage of pulses.	Banks to accommodate longer duration storage of pulses to at least 4-5 months to enhance viability of processing units.
3.4	Dal millers not aware of schemes of the GoI Including CLCSS, cluster Development scheme or “Sampada” for technology upgrading.	Awareness seminars for processors

Bajra:

#	Constraints	Action
1.	Production	
1.1	High production cost due to cost of seed and Agri input requires like fertilizer pesticides etc.	Pooled procurement through FPCs to reduce cost of inputs and ensure quality inputs.
2.	Post-Harvest	
2.1	Moisture content of harvested Bajra is high, because of that farmers get less price.	To make Framers aware about market price of bajra proportionate to moisture content, making availability of moisture meters in FCSC
2.2	High dirt content /foreign material in harvested millet	Ensure availability of the Cleaning & Grading facility to farmers; usually in 10% higher income accrual to farmers.
2.3	Lack of market information related to price	Price discovery through NCDEX, eNAM
2.4	5 / 11 quintals/acre in poor/good harvest. During good harvest prices Collapse and hence storage option could help and distress sale.	Storage facility for farmers as part of FCSC
3.	Processing	
3.1	Not aware of special license option to source directly from farmers /FPOs	Awareness seminars for farmers/Processors
3.2	Limited processing products are available in bajra	Promote handmade Namkeen bajra product
3.3	Lack of proper Product marketing	Awareness on Product Branding
3.4	Processor not aware of schemes of the GoI Including CLCSS, cluster Development scheme or “Sampada” for technology upgrading	Awareness seminars for processors

Isabgol

S.no	Constraints	Action
1	Production	
1.1	Many a time's seed prices rise very high due to speculation during sowing time.	Seed production program using sources of Raj seeds through FPC
1.2	Many farmers use local seeds for more than 3-4 years causing problems in germination and yield.	FPC to take up seed and other agri input distribution for member farmers
1.3	Slightest rain during harvesting could damage the entire crop	Weather forecasting services for farmers
2	Post harvest	
2.1	Dearth of adequate storage facility for seed protecting from moisture	Storage facility for farmers as part of FCSC through FPC
2.2	Large no. of intermediaries in the value chain leads to low producers income	Middlemen to be replaced by FPC. FPC would directly procure from farmers and sell to processors
3	Processing	

S.no	Constraints	Action
3.1	Lack of cleaning and packaging facilities which result in losses	Provision of cleaning and packaging facilities as part of FCSC through FPC
3.2	Limited number of processing units such as guar gum processing unit in the region	Facilitate start up in secondary processing from among FPC members or individual entrepreneurs; ties with large players such as Hindustan gum

Goat:

#	Constraints	Action
1.	Production	
1.1	Non availability of good variety of goats	Distribution of good variety goats
1.2	Health issues of animals	Animal health services through AH Department
1.3	Nutrition issues of goats	Farmers to be made aware of improved feed practices through training from AH department
1.4	Non availability of updated technology on animal rearing and management	Establishment of Rural technology Centre (RTC)
2.	Post harvest	
2.1	Entire supply channel of live animals to market captured by multiple level of middlemen	Establishment of Rural hat Promoting FPO operating from rural hat
2.2	Milk channel not well developed	Establishment of chilling units, milk processing and value addition facility. FPC to take up milk marketing units

Total Investments in Ladnun Cluster

A total investment of **Rs.3,644.96 lakh** is proposed to be incurred in the cluster during the project period to make the farmers and cluster competitive to get improvement in water as well as agricultural productivity and better market access. The summary of phasing is being given as hereunder:

S. No.	Department	Components (Rs. Lakh)				Total
		Climate Resilient Agriculture	Market & Value Chains	Farmer's Organization and Capacity Building	Project Management and M&E	
1	Watershed Development & Soil Conservation	1154.55	0	21.79	20.00	1196.34
2	Agriculture	990.56	232.00	123.33	9.00	1354.89
3	Horticulture	545.80	-	36.00	11.00	592.80
4	Animal Husbandry	249.21	31.00	12.05	10.07	302.32
	Total	2940.12	263.00	193.17	50.07	3446.35

The above table reveals that total investment amounting to **Rs.3,446.35 lakh** would be incurred during the project period by March 2019 against activities related to improving water use efficiency, technology transfer and market led advisory services, livestock strengthening & management, market & value chains, farmers organization and capacity building, project management, along with monitoring & evaluation to make the cluster's farmers and production competitive to increase water and agricultural productivity. Out of the total investments, 85.31% would be incurred on the first component, i.e. Climate Resilient Agriculture, 7.63% on Market and Value Chains, 5.61% on Farmers Organization & Capacity Building and 1.45% investments would be incurred on 4th Component i.e. Project Management & M&E.

The comparison of investment (in Rs crore per mcm) is a useful tool for assessing data to understand the relative effectiveness and cost of the full spectrum of approaches to improving water

security. When coupled with realistic assessments of operational risk, such comparisons can also help policy makers and investors to improve water-sector productivity.

In the case of Ladnun cluster, there are majorly two water saving activities taking place viz activities of Watershed department and the micro-irrigation system (MIS) activities of Agriculture and Horticulture department. Both these activities save water up to the extent of 0.28 mcm and 5.80 mcm per year respectively. When the investment per unit of water saved is calculated, it is found that Watershed activities are able to investment more amount of Rs.41.24 crores per mcm and MIS activities are able to conserve more water per investment of Rs1.10 crore per mcm of water per year. Thus, it could be said that in Ladnun, MIS activities like installation of drips and sprinklers for the agricultural and horticultural crops can be economic means of saving water in span of a year.

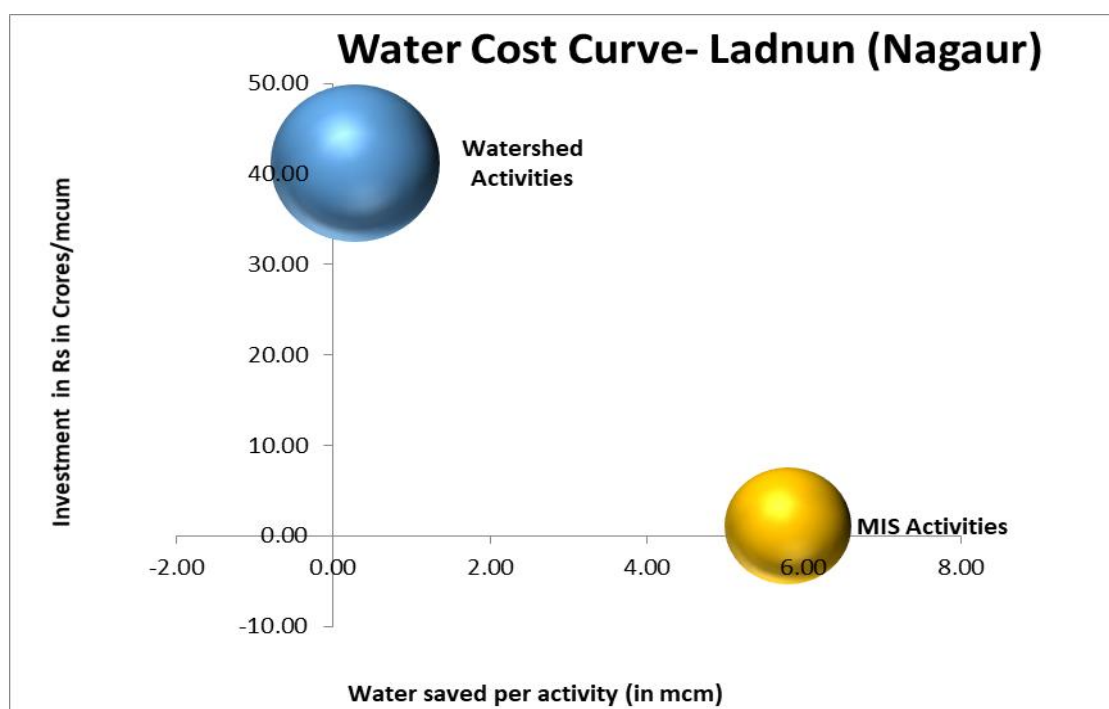


Figure 1 Investment (Rs crore/mcm) verses Water saved (mcm) per year

Table 1 Investment (Rs. crore/mcm) verses Water saved (mcm) per year

Activities undertaken to save water	Water saved- in mcm per year	Investment- Rs crore/mcm	Total investment- Rs crore
Watershed activities	0.28	41.24	11.55
MIS Activities	5.80	1.10	6.39

Out of above investments, more than 4288 households will be benefitted and will lead to at least 5% increase in productivity and considerable increase in gross margin of the target community. Additionally, the community institution building and infrastructure created will benefit the much larger population in a sustainable way even after the project period. It is also expected that the best learning will be replicated in a similar area to benefit the farming community on larger scale. Summary of overall benefits:

1. Reduced cost of cultivation – 5%
2. Productivity improvement – 5%
3. Improved market access - 15%
4. Overall targeted benefit – 25

Chapter – 1: Context and Background

The World Bank has approved credit amounting to Rs.832.50 crore for development of 17 clusters, each having area ranging from about 10,000 ha to 31,500 ha in eight agro-climatic zones across the Rajasthan to provide end to end solution to farmer's problems in three main water regimes namely Canal Water/rain-fed, surface/canal water and ground water, having some specified desired selection criterion.

The Project Development Objective (PDO) is to establish the feasibility of sustainably increasing agricultural productivity and farmer incomes through a distinct agricultural development approach by integrating agriculture water management and agricultural technology, farmer organizations and market innovations in selected locations across the ten agro-ecological zones of Rajasthan. The aim is for the state to help farmers get more rupees per unit of water in compensation for farmers using fewer units of water.

The guiding principles i.e. (a) sustainable and efficient use of water resources, including improved on-farm water use efficiency, reduced water-intensive cropping patterns, and using the resultant savings of water from agriculture sector for economic purposes outside of agriculture in support the state's water policy objectives; (b) increased private sector participation in the development of value chains in processing and marketing in support of the state's agro-processing and agri-business policy; and (c) improved public sector capacity in delivering agriculture support services are to be ensured through the investments.

The Key performance indicators (KPIs) (a) reduction in water used in agriculture; (b) increase in water use efficiency in agriculture; (c) increase in agricultural productivity; (d) increase in gross margins from crops and livestock products; (e) increase in the share of producer price in wholesale price; and (e) farmer satisfaction with project deliverables will also be measured under the project.

There are four components under the project: Component 1: Climate Resilient Agriculture; Component 2: Markets and Value Chains; Component 3: Farmer Organization and Capacity Building; and Component 4: Project Management, Monitoring and Learning. Implementation of the four components will take place over the project period and across selected clusters in the state. The project will be taken up in seventeen (17) clusters across the eight agro-ecological zones (AEZ) and would implement a location-specific menu of approaches and interventions would be discussed in the CACP. Each cluster will have a defined theme and demonstration objectives and accordingly cluster specific menu of investments are to be proposed for implementation in the cluster during the project period.

After restructuring the project, it was decided that planning and implementation of the project would be done by line departments in place of Service Providers (SP) as decided at the time of signing of the agreement and community mobilization at cluster level would be done with the support of Field NGOs. Dy. Director Agriculture, Jila Parishad, at district level has been designated as District Project Manager and his office has been designated as office of the District Project Management Unit (DPMU). All concerned offices of the line departments at district level would be Project Implementation Agencies for planning and implementation of project activities in the cluster. There is District Level Implementing Committee (DLIC) will be responsible for coordination and implementation at district as well as at cluster level. District Collector is

chairperson of the committee, DPM, DPMU is member secretary and other district level officers / PIAs of the line departments are the members of the committee.

1.1. Brief Description of the CACP

The Cluster Agricultural Competitive Plan (CACP) is primary requirement of the cluster to be developed keeping in mind Project Development Objective (PDO). The CACP is divided in to eight chapters and whatever discussed in the chapter is being summarized as under:

First chapter includes context and the background, brief description of the CACP, objective of the RACP and rationale for selection of the cluster.

Second chapter consists of description of the cluster in terms of spatial characteristics, agro ecological characteristics, demography of the cluster, agriculture characteristics that includes agronomy, horticulture, Micro Irrigation Systems and Seed Replacement Rate. Further there is a description on livestock scenario in the cluster and market infrastructure that can have impact on the cluster.

Third chapter discusses the strategic contexts of choosing the value chain crops for the cluster. Scoring matrix designed to select the value chain crop has been detailed out along with the parameters for the same. Thereafter, the inference is drawn from the scoring model in order to finally select the major value chain crops. Then the current marketing channels of the selected VC crops have been described. Similarly goat value chain has been discussed in the present context of the cluster with respect to goat milk, meat, leather, illustration of organized market channel and fodder requirement for the same.

Fourth chapter includes opportunities and challenges in selected value chain/s along with summary of selected value chain crops that includes the constraints for the crops and the possible interventions.

Fifth chapter is related to the value chain investments to be done in the cluster under production and market and value chain sub component which includes rationale for these investments, non-water-use interventions in value chain, investments related to technology transfer and market led advisory services (agriculture & horticulture), livestock strengthening & management, interventions in market & value chains, value chain studies of identified commodities in the cluster of selected crops in the cluster, scouting of technologies and business ideas for such identified commodities, incubation services to agri-entrepreneurs, management and business training to FCSC and producer companies personnel, facilitating agri policies, linking producers groups to market, market infrastructure and reference business models of selected value chain crops, training and capacity building, market information services, cost estimate of investments, summary of proposed investments, brief description of implementing arrangements.

Sixth chapter is discussing about rain water management of the cluster to develop selected commodities as a pilot which consists description of watershed cluster, water budgeting including hydrological cycle, water budgeting exercise for the project area, water budgeting for the project area, calculations, objectives of the water management in watershed cluster, proposed activities in the watershed cluster including studies/Field Surveys, institutional activities, trainings, watershed development activities to be implemented, site specific plan & cost estimates of the activities, estimated cost of Investments under watershed management, implementation arrangement for all the planned activities in the watershed Area.

Seventh chapter includes social and environmental assessment of the proposed activities: social assessment of the proposed activities, the social assessment exercise has highlighted the following key social safeguard and social development issues, social inclusion strategies, social management plan under RACP and environment assessment of the proposed activities - environment management plan for crop intensification, environment management plan for water harvesting and water management, environment management plan for livestock management activities, environment management plan for value chain activities, training plan for implementation of

environment management plan (EMP), objective of training plan, training type, target groups & frequency.

Eighth chapter is consisting department and component wise consolidated investments plan to be incurred in the cluster.

The Cluster Agricultural Competitive Plan (CACP) is consisting of investments to be made on improving water use efficiency, technology transfer and market led advisory services in agriculture & horticulture development, livestock strengthening and management specially for small ruminants, market and value chains in the cluster.

1.2. Objectives of the CACP

The Cluster Agricultural Competitive Plan (CACP) is the outcome of a planning process that aims to (a) identify opportunities as well as constraints towards developing one or two or more value chains in which the community deem themselves to have a potential competitive advantage and to (b) select from a list of eligible project investments and within the funding constraints of those public investments that will enable the community to address constraints and enhance opportunities towards establishing identified value chains. The value chain proposed would envisage addressing broad sub-sectorial issues as well as help establish specific partnership arrangements between farmer groups or producer organizations with agribusiness companies.

1.3. Rationale of selection of the cluster

The Rajasthan Agricultural Competitiveness Project (RACP) will be implemented in selected locations of the particular agro-ecological zones (AEZ) in Rajasthan. The AEZ will be supported by one or several commodities in a value chain approach. The same commodity can be supported across two and up to three AEZs. Commodities can include traditional crops (annual, perennial) cultivated in Rajasthan and for which an AEZ is believed to have a comparative advantage; or new crops for which a clear rationale and analysis exists that a comparative advantage can indeed be established over time. Small ruminant (goat and sheep) development will be taken forward as a value chain in 8 Agro-Climatic Zones.

Within an AEZ one District will be identified across which cluster will be developed with a primary focus on improving water management across the three water sources, i.e. either canal water or ground water or harvested rainwater (watersheds).

The principles for Cluster selection include: (1) Each Cluster provides for a demonstration or pilot on how to effectively support sustainable and profitable agriculture with a view towards potentially scaling up this model (if successful) in the future (outside of the RACP). For a Cluster to be “testable” it requires a defined theme, demonstration objective and research/development hypothesis that needs to be made explicit at the on-set and supported through the definition of a results framework (key indicators, baseline and monitoring arrangements). (2) If multiple Clusters are identified within one Cluster (based on selected lead commodity), these Clusters will be implemented within the same District to facilitate implementation. (3) For each Cluster the relevant hydrological catchment area will be identified which provides for the basis of water resource management activities. (4) Each Cluster will comprise at least 10,000 ha of cultivation for the lead commodity under the Value Chain approach.

Keeping in view the principles of the cluster selection, the Ladnun cluster has been selected to achieve the Project Development Objective. The Ladnun cluster is a watershed (Index catchment) cluster which is a hydrological unit. The Ladnun watershed (Index catchment) cluster is situated in II-A Agro-climatic Zone (Internal Drainage Dry Zone). Ladnun is a tehsil headquarter of Nagaur and cluster is located about 123 Km from Nagaur. The Ladnun Cluster (Rainfed – index catchment area) in Nagaur district has been selected to be developed under the RACP after undertaking various field visits by the PMU coordinators and having consultations with the officials of WD&SC Department, Jaipur & Project Manager, WCDC cum Ex. En. (Land Resources), Zila Parishad, Nagaur and interactions with the local community, following un-treated area as per details provided by the WD&SC Department have been identified. Nodal Department i.e. Watershed Development

& Soil Conservation, Government of Rajasthan has agreed for taking up this area under RACP cluster. This was approved from the competent level.

The area is predominantly rich in agriculture and livestock rearing. The average rainfall of this cluster area is approximately 413 mm (in Ladnun). As elsewhere discussed, total cropped area is about 12435 ha, out of which 8851.74 ha is in Kharif and 9420.03 ha is in Rabi season. Bajra crop is sown in about 3632 ha, Greengram in 2098.02 ha, Cluster Bean in 793 ha, Cow Pea in 791.01 ha, Sorghum in 497 ha, Sesamum in 482 ha & Groundnut in 342 ha. In Rabi season Isabgol is being grown in 1190 ha, Wheat in 735 ha, Mustard is sown in 425 ha, Fenugreek in 211 ha, Barley in 177 ha Gram in 97 ha, Cumin in 60 and Taramira in 24 ha. Only 32 ha i.e. 0.26% area is sown in horticultural crops. Total of area under the above crops makes a total cropping intensity of 99.49%. The above crops which are sown in the cluster are also the main crops in the district. So, surplus production of major crops is generally available in the area.

The production of pearl millet & sorghum is being sold through unorganized local market and mandi of Ladnun and Nagaur. Apart from human consumption most of the produce of pearl millet including other similar crops is being used as cattle feed, hence looking to the enough livestock population of Nagaur district, there is a considerable scope of value addition in these crops. Similarly Greengram crop in Kharif and in Rabi Isabgol crop may be selected as value chain in cluster because these crops are having industrial value for development. Apart from this, the area being sown under less paying crops would be diversified into cultivation of high pay off crops like Isabgol and other horticultural crops in future.

In view of the major crops which are being grown in Rabi season and the scope of Isabgol & Mustard as alternate crop (looking to the possibility) for medicine and oil respectively; these would also be selected as value chain crops for the cluster. Since industrial value of the Pearl Millet, Greengram, Isabgol and Mustard crops are significant for any Producer Company (PC), so these crops may be taken as value chain crops in Ladnun Cluster.

Although there is not much area under Horticulture/fruit plantations at present, the availability of average land and availability of ground water puts immense opportunity for the cultivation of vegetables and fruits. The area is fairly suitable for fruits like Pomegranate, Lemon, Ber etc. & vegetables like Onion, Okra, Pea, & Tomato Crops. Hence, some area under cereal & other crops would be diversified in to the cultivation of above these vegetables and fruits crops.

As the dairy is experienced quite successful business in the cluster, cultivation of fodder crops has an important role in the cropping pattern to the local farmers. Similarly, the Goat rearing is quite popular in this area. About 17753 numbers of goats are available in the villages of the cluster, so there is a significant scope of value chain of goat meat.

Therefore, it can be concluded that the availability of sufficient land and underground water along with the proximity to Pushkar, Ajmer & Bikaner provides enough opportunity for the development of value chain crops and cultivation of vegetables and fruits, as well as scope of value chain in goat meat production. Therefore, Ladnun is an appropriate cluster to be developed under RACP.

Chapter -2: Description of the Cluster

2.1. Spatial characteristics

Ladnun index catchment cluster of Rajasthan Agricultural competitiveness Project is located in Ladnun Block of Nagaur district between the latitudes 27°28' N & 74° 20' longitudes. Ladnun cluster of Nagaur district falls in IIA Agro-climatic Zone (Internal Drainage Dry Zone). It is at a distance of 10 km from its Block headquarters and 123 Kms from the district headquarters. The area of the cluster is spread over in 10 villages of 5 Gram Panchayats. The name and area of the Gram Panchayats and villages covered in the Project area are given in Annexure 2.1.

2.1.1.Land Use Pattern of the Cluster

Total area of the cluster is 14527 ha. Out of this, the cultivated area is 12434.61 ha with 8756.21 ha rainfed, 3582.87 ha irrigated and 95.53 ha temporary fellow land. Apart from this an area of 30.15 ha is also temporary fellow and belongs to the community. The pasture land which belongs to Panchayats of Ladnun Cluster is 1089.34 ha and waste land is only 8.65 ha and other land is 997.92 ha which belongs to Government and Community of the cluster. The detail land use pattern of the cluster is summarized hereunder:

Table 2: Land Use Pattern of the Ladnun Cluster

S. No.	Land Use	Total area in ha				
		Private	Panchayat	Government	Community	Total
1	Agriculture Land	12434.61	0.00	0.00	0.00	12434.61
2	Temporary fallow	95.53	0.00	0.00	30.15	125.68
3	Waste land	0.00	0.00	8.65	0.00	8.65
4	Cultivated Rainfed	8756.21	0.00	0.00	0.00	8756.21
5	Cultivated irrigated	3582.87	0.00	0.00	0.00	3582.87
6	Water body	0.00	0.00	1.09	0.00	1.09
7	Settlement	0.00	0.00	649.49	44.78	694.27
8	Pastures	0.00	1089.34	0.00	0.00	1089.34
9	Others	0.00	0.00	255.24	13.65	268.89
	Total (2 to 9)	12434.61	1089.34	914.47	88.58	14527.00

(Source: DPR of Watershed of Ladnun Cluster)

2.1.2. Current status of Connectivity

At present there is unorganized market in the cluster and farmers sell their produce in the local markets. Didwana mandi is the nearest mandi which is around 50 Kms away from Ladnun cluster. Nagaur mandi is 80 Kms away from cluster. Nagaur city is district head quarter of the cluster.

2.2. Agro-ecological characteristics

2.2.1. Slope

The slope of the Ladnun project area ranges from the 0 to more than 1%. The area is almost plain. The category wise and micro watershed wise slope area is being summarized under:

Table 3: The slope of the Ladnun Project area

S. No.	Slope percentage	Area in hectares
1.	0 to 1 %	14527
	Total	14527

(Source: DPR of Watershed, Nagaur)

2.2.2. Soil Types

The soil of the Project Area is shallow to moderately deep, dominantly sandy loam soils, imperfectly drained, and moderately to severely eroded. Topography of the Project Area is almost plain and majority of the area falls in the slope up to one per cent. The soil profile of the project area is being summarized as under:

Table 4: Soil Profile of Ladnun Cluster

S. No.	Major Soil Classes	Area in hectares
1.	Sandy loamy	14527
	Total	14527
Soil Depth :		
S. No.	Depth (cm)	Area in hectares
1	> 45.00	14527
	Total	14527

(Source: Agriculture Department, Nagaur)

The Soil fertility level of the Project Area is given as under:

Table 5: The Soil fertility level of the Project Area

Soil fertility Status	Kg/ha	Recommended
N	40	90
P	24	30
K	12	10
Micronutrients	PPM	Recommended
Zn	0.32	0.6
Fe	1.78	4.5

(Source: Agriculture Department, Nagaur)

The analysis of soil data given in the above table shows the need to improve and maintain the soil fertility. Soil health card to every farmer, every crop season is proposed to be provided, which will

include the recommendation for application micro nutrients and fertilizers as well as organic manures.

The need is:

- To check land degradation
- To reduce excessive biotic pressure by maintaining optimum number of livestock and management
- To check cultivation on sloping lands without adequate precautions of soil and water conservation measures
- To discourage cultivation along susceptible nalla beds
- To check faulty agriculture techniques
- To check uncontrolled grazing and developed cattle tracks
- To check deforestation of steep slopes
- **For delineated watershed projects:** To check erosive velocity of runoff, store Runoff, to arrest silt carried by runoff and to recharge Ground Water and structures like Tanka.

2.2.3. Rainfall Pattern in Project Area

This part falls under semi-arid climate. Winter season is observed between mid of November to March followed by summer season extending till June. July to September is the period in which rainfall occurs.

The identified project area falls under the Indian Metrological Department (IMD) Station named Ladnun (Nagaur) which is also Tehsil headquarter at Nimbi Jodha.

The average rainfall data are required to carry out water budgeting and based on which appropriate water harvesting structures are to be proposed in the cluster. The average rain fall data have been obtained from Irrigation Department of Ladnun, Nagaur district, Government of Rajasthan by the Watershed Department. The rain fall data as obtained and given in the following table have been utilised while planning watershed development interventions in the cluster (Refer Annexure 2.7). The average rainfall of the cluster area is 413 mm which has been used for calculation of water budgeting and similar other aspects.

2.2.4. Temperature

The temperature during the summers (from April to July) remains high and generally reaches up to 47°C. Hot wind commonly known as “Loo” blows between the months of May-June. On the other hand, winters have sunny and pleasant days and bitterly cold nights. Temperature can touch the lowest level which is around 0°C, mostly during the nights.

2.2.5. Source of Irrigation

Ladnun cluster is a watershed cluster, so the rainwater is the main source of water which is required for crop production in Kharif season. The rainwater is also the main source of ground water recharge in the cluster. The Kharif crops are cultivated based on the rain water received during the monsoon. In Ladnun cluster the main source of irrigation is rain fall recharged ground water which is mainly used in Rabi season. The source (method) of ground water/extraction and related details as well as area irrigated is being summarized as under:

2.1.1.1. Ground Water Status in Ladnun Cluster

Hydrology

The principal source of recharge to ground water is rainfall. Normal monsoon and Normal non-monsoon rainfall (mm) from 1901-2008 to 1901-2012 and annual monsoon and non-monsoon

rainfall (mm) from the year 2008 to 2012 of the Block Ladnun district Nagaur are given in **Annexure-2.14**. In canal irrigated areas, a part of canal water through seepage from conveyance system and part of water utilized for irrigation that returns to ground water contribute to storage.

To study about ground water occurrence & its movement, the various litho units have been classified on the basis of their degree of consolidation and related parameters. The Aquifer in the Cluster area is Sandstone. The presence of bedding planes, joints, contact zones and fractures controls the ground water occurrence, movement and yield potential. The availability, occurrence and movement of ground water depend upon the topography, structures, geomorphology and hydrological properties of the water bearing materials. Ground water occurs under unconfined to semi-confined conditions.

Ground Water Level

Ground Water department is monitoring two wells in the Cluster Area. The average Pre-Monsoon depth water varies from 44.73 mts to 49.13 mts below ground level and Post-monsoon depth from 44.25 mts to 48.60 mts. The Water levels are given in **Annexure. 2.14**).

Water Level trends (2003 – 2016)

14 years Water Level Trend for Pre monsoon and Post monsoon 2003- 2016 has been presented in figure-1 & 2 respectively. During Pre-monsoon period in the long term, decreasing trend of ground water levels of 0.86 m/year has been observed. Decreasing trend of 0.85 m/year in ground water levels of Post-Monsoon period from 2003 to 2016 has been observed in the Ladnun Block. **The Water levels and trend are given in Annexure- 2.14.**

Ground Water Extraction Status

Existing Gross Ground Water Draft of 4.21 MCM for Irrigation are withdrawn through 192 wells/Tube wells for irrigation purposes in the Ladnun Cluster area. The details are given in Table-2 of **Annexure- 2.14**. Existing Gross Ground Water Draft of 1.93 MCM for Domestic purposes are withdrawn from Wells/Tube wells/Hand pumps. The details are given in **Annexure-2.14**.

Stage of Ground Water Development:

Stage of ground water development in the Ladnun Cluster area as on 31.3.2013 is 145.48%, which indicates that the scope of ground water development for Irrigation purposes is already exhausted. The Ladnun Cluster area is coming under Over-Exploited Zone. (**Table-7 of Annexure-2.14**)

In Over-Exploited areas where there should be intensive monitoring by an accurate measurement of ground water extraction in the aquifer and evaluation and future ground water development are linked with water conservation measures as well as efficient on following on farm water usages so that present Draft for irrigation **be reduced to 2.29 MCM bringing a balance between water recharge and extraction over time** for Sustainable Ground Water availability.

- a) Efficient use of ground water on farm water usages through:
 - i. Demonstration of water efficient technologies for irrigation (Drip & Sprinklers etc.)
 - ii. Promotion of high value agriculture as well as
 - iii. Promotion of crops introduced and/or supported as part of improved crops rotation and management practices with lower water requirements.

In Over-Exploited areas one Piezometer installed with Digital Water Level Recorder (DWLR-Telemetric) should be constructed on 10 Sq.km areas or site specific requirement for monitoring of impact assessment of Investments proposed in the Cluster area.

Based on the above data, the ground water level is decreasing at the rate of 0.86 m per year and currently 4.21 MCM is being drafted for agriculture use and 1.93 MCM for domestic use. Total ground water is available 4.23 MCM annually in the cluster and the total draft has to be reduced to 2.29 MCM for maintaining water balance in the cluster.

2.3. Demographic Characteristics

Ladnun cluster comprises of five (5) Gram Panchayats having ten (10) villages. The villages falling in the Project Area are characterized by low and undependable rain, ground water is the only source of irrigation, poor infrastructure development, low literacy and high incidence of migration during times of drought. Total population of the cluster is 26323.

2.3.1. Population

Out of the total population, female population is 47.81% and schedule caste (SC) population is 22.22% and 0.02% is schedule tribe (ST) population. During the implementation of the project activities the involvements of all farmers/households have to be ensured whether these are from lower backward and other weaker classes or upper classes.

Table 6: Population Details

Male	Female	Total	SC	ST
13739	12584	26323	5848	5
52.19%	47.81%	100%	22.22%	0.02%

(Source: Watershed DPR of Ladnun Cluster)

2.3.2. Socio-economic condition of the cluster

The table below shows that almost 50% of the farmers are small and marginal farmers. The cluster also has a significant number of landless farmers.

Table 7: Household Details

BPL household	Land Less	Small Farmer	Marginal Farmer	Large Farmer	Total household	SC household	ST household
678	783	1122	1006	1377	4288	807	1
15.81%	18.26%	26.17%	23.46%	32.11%	100.00%	18.82%	0.02%

(Source: Watershed DPR of Ladnun Cluster)

The poor source of irrigation, poor infrastructure development, low literacy and high level of migration are predominantly observed during times of drought. The development indicators of the project area are being summarized under:

Table 8: The development indicators of the project area

S. No.	Development Indicators	Rajasthan State	Project Area
1	Per capita income (Rs.)	16260	15749
2	Poverty ratio	0.22	0.32
3	Literacy (%)	60.40%	48.21%
4	Sex Ratio	1000:928	1000:915
5	Infant mortality rate	NA	NA
6	Maternal mortality ratio	NA	NA

(Source: Watershed DPR of Ladnun Cluster)

The above table indicates average socio economic conditions of the cluster. However, per capita income of the project area is less than the state average. Although poverty ratio is more than the state average, literacy is less than the state average in the cluster. All these parameter needs to be

increased significantly in the project area for understanding the development to the occurred after the project implementation.

2.4. Agriculture-related livelihood characteristics

Agriculture is the chief contributor towards the economy of the district. Nagaur district occupies an important place in the agricultural production of the state. It falls in II-A Agro-Climatic Zone (Internal Drainage Dry Zone) as discussed earlier. It is located 123 Kms from Nagaur district and 10 Km from Ladnun Gram Panchayat and 195 Kms from Jaipur. The total geographical area of the district is 1763821 hectares which is about 5.15 per cent of the state. Out of this, the net area sown is 1292679 ha. Out of this the rainfed area is 1047207 ha and irrigated area is 245472 ha. At the same time some area is also double cropped with the help of irrigation and hence the total cropped area is 1757833 ha. So the cropping intensity of the district is 136% against the state average of 143%.

2.4.1. Cropping Pattern of Agricultural Crops

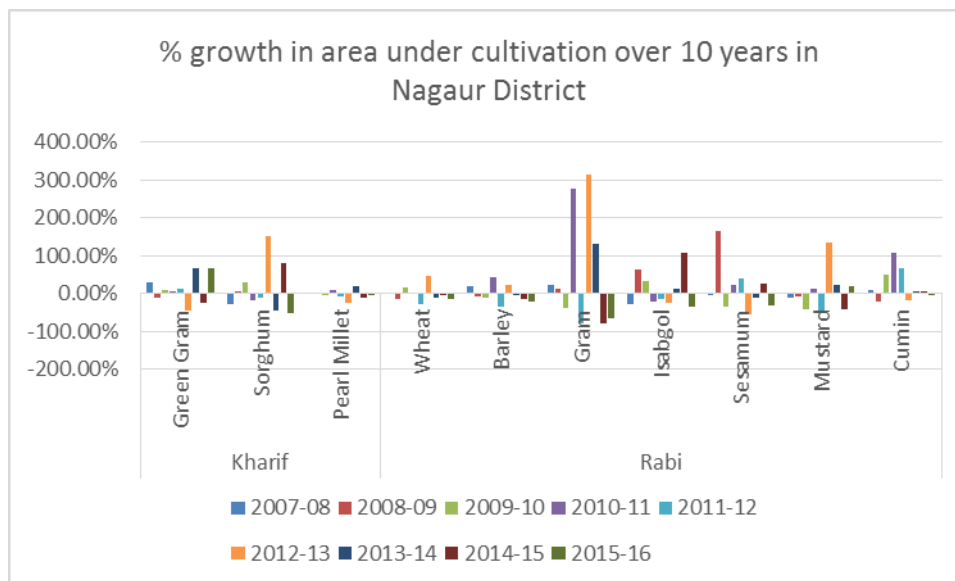
A number of crops are grown in Nagaur district. In the Kharif season, Pearl Millet (Bajra), Sorghum (Jowar), Kharif pulses like Green Gram, Moth Bean, & Sesamum (Til) etc. are sown in about 1172800 hectares which is 7.63% of state's Kharif area (15369717 ha). In the Rabi season Isabgol, Wheat, Barley, Gram, Mustard, Cumin etc. crops are cultivated in about 330789 ha which is 3.55% of state's Rabi area i.e. 9308039 ha. Thus, the total cropped area of the district is 1503589 ha. The prime sources of irrigation here are wells and tube wells. A total area of around 245472 hectares is being irrigated by 22129 tube wells & 18316 wells in the district. By other sources, an area of only about 38 ha is irrigated.

Based on the crops are being grown in cluster cropping pattern of 10 years (from 2006-07 to 2015-16) has been compiled from data received from Agriculture department in table No. 6, 7 & 8. The table 6 clearly shown the increase / decrease area in the year 2015-16 over the year 2006-07 data in ha & %. There is almost constant cropping pattern in Kharif crops over 10 years' area in state as well in Nagaur district, only about 8.58% area is decreased in Pearl Millet crop Nagaur district. This decrease is due to delay in rains and diversification of farmers towards Cumin and Isabgol crops. In Rabi crops cropping patter is almost constant and deviating (increase & decrease) is ranges from (-) 1.27% in Wheat to 2.94% in Cumin crops.

The cropping pattern is almost constant over the 10 years in state as well as in district is except Green Gram, in this crop there is an increase of 13.04%, because these crops are well accepted by the farmers of the area. If there is any increase/decrease or any deviation in cropping patter it is due to delay rains or excess rains. Sometime crops are dried due scanty rainfall or monsoon finished before time. In such circumstances crops could not get ripen and harvested properly resulting productivity may also affect adversely.

The Annexure 2.2 shows that the Green Gram is being grown in 27.04%, Pearl Millet in 9.29%, Sorghum in 8.90% and Sesamum in 4.23% area over the state average. Whereas in Rabi crops Taramira is being grown in 26.36%, Isabgol in 17.31%, Cumin in 10.42%, Barley in 4.52%, Mustard in 2.58%, Gram in 2.55% and Wheat crop is being grown in 2.54% area over the state average.

Figure 2: Percentage growth in productivity (kg/ha) under crop cultivation over 10 years in Nagaur District



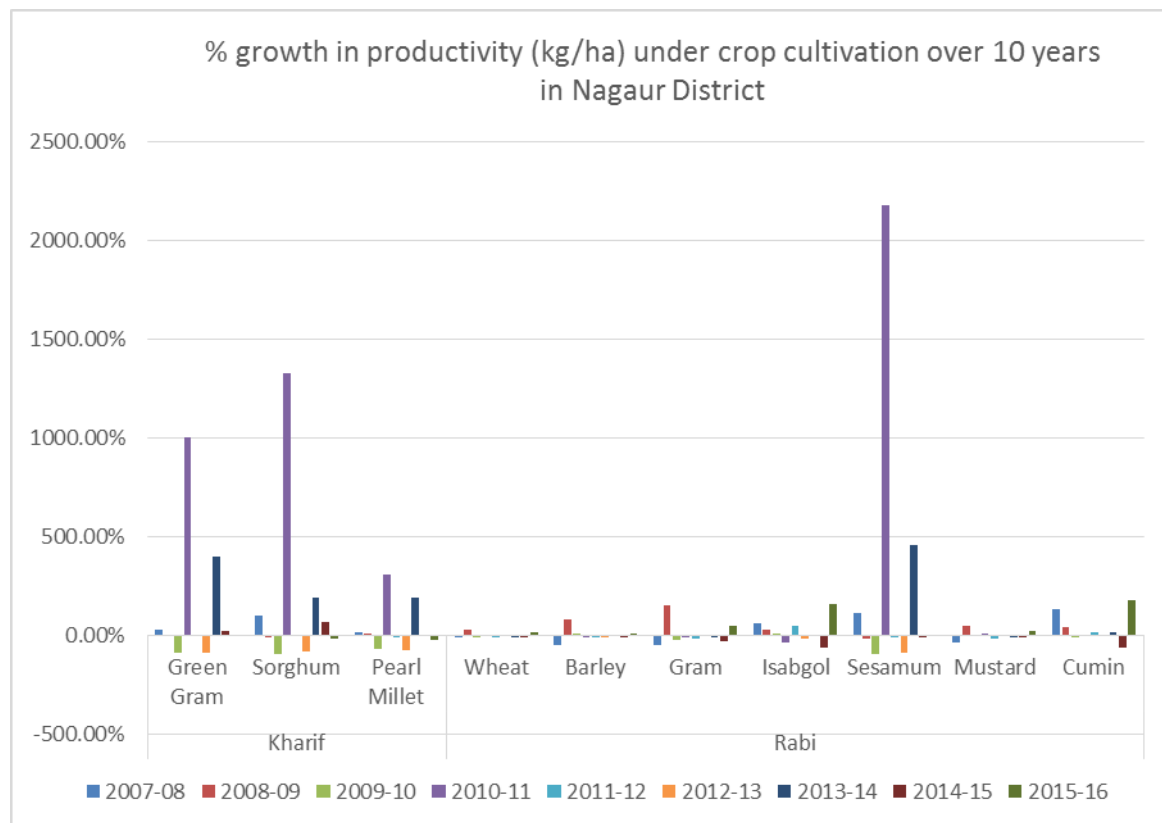
(Source: Data analysis by ABPF)

The detailed cropping pattern may be seen in Annexure 2.2. State level data and district level data both are presented in Annexure 2.2.

Finally, Pearl Millet and Green Gram in Kharif and Isabgol crops are most suitable crops in Rabi season. The same crops have been selected as value chain crops in the Ladnun cluster.

As far as crop productivity is concerned, the crop productivity of the district is 115Kg/ha in the case of Green Gram, Sorghum 308kg/ha, Sesamum 92Kg/ha more than the state, 47 kg/ha in Pearl Millet, less than in the case of Kharif crops. Whereas in Rabi crops, the productivity is 68 Kg/ha in Barley, Gram 294/Kg less than whereas the productivity is 30 Kg/ha in Mustard, 496 Kg/ha in Wheat, 336 Kg/ha in Isabgol, 489 Kg/ha in Cumin and 62 Kg/ha in Taramira in Nagaur district more than the state average.

Figure 3: Percentage growth in productivity (kg/ha) under crop cultivation over 10 years in Nagaur District



As per the **figure 3**, the growth in productivity of Green Gram and Sorghum is shown as 1001% and 1329% respectively in cluster in year 2010-11. The reason behind the huge deviation was that the year 2009-10 was a drought year and crop failure cases may have been more. In terms of rabi crops, Sesame crop has shown maximum growth in year 2010-11 with 2182%.

2.4.1.1. Overview of the crops identified in Ladnun Cluster

The Ladnun cluster is situated near to the tehsil Ladnun, so nomenclature of the cluster is based on the name of the tehsil i.e. Ladnun of Nagaur district. The cluster has been selected based on the basis of watershed approach. Therefore, improvement in water use efficiency would be achieved through watershed management and Agricultural productivity including agricultural & horticultural crops would be increased by way of ensuring water availability whether in-situ moisture conservation or water harvesting in existing water harvesting structures or in proposed water harvesting structures or through conservation measures to be adopted/constructed in the cluster. As far as cluster area is concerned, the total area is 14527 ha and a total of 10 villages falling in 5 Gram Panchayats are there in the cluster.

2.4.1.2. Category wise Cultivated Area in Ladnun Cluster

Using remote sensing and Geographical Information System (GIS) and Participatory Rural Appraisal (PRA), the irrigated and rainfed area has been assessed. Using revenue as well as remote sensing data category of the farmers has been compiled into large, small, marginal and below poverty line (BPL) farmers as well as landless households. At the same time the farmers have been categorized into General, scheduled caste, scheduled tribe and other back ward classes. The total cultivated area of the cluster is 12434.61 ha and the total households in the cluster are 4288 4966. The category wise cultivated area in Ladnun cluster is being summarized in Annexure 2.3

2.4.1.3. Status of Cropped area of Agricultural Crops in the Ladnun cluster:

The cropped area has been compiled from the data collected while Participatory Rural Appraisal (PRA) which was performed by Watershed Development and Soil Conservation Department during the year 2015-16. As discussed earlier, the major field crops of Kharif are Pearl-millet (Bajra), Sorghum, Green Gram, Moth Bean, Cow Pea, Cluster Bean, Sesamum (Til) and Groundnut whereas Isabgol, Wheat, Barley, Gram, Mustard, Taramira, Fenugreek and Cumin crops are important crops in Rabi season in Ladnun cluster. Kharif crops are mostly grown on the basis of Monsoon rains. However, lifesaving irrigation is provided during the dry spells wherever irrigation facilities are available. The crop wise area under these crops is being summarized in Annexure 2.4

2.4.2. Cropping Pattern of Horticultural Crops

Similarly, for better integration, the area under the horticultural crops has also been gathered from the Agriculture department. The area under horticultural crops is very less in comparison to agricultural crops because looking to the potential of the state as well as the district, area is increasing very slowly under horticultural crops i.e. fruits and vegetables crops. So there is a scope to increase area under horticultural crops and efforts need to be made by the concerned department. In case of Ladnun cluster the Onion, Pea, Okra & Tomato crops are most encouraging vegetable crops and similarly Pomegranate, Lemon and Ber fruit crops are suitable for the Ladnun cluster.

Year and Crop wise area of horticultural crops in Rajasthan and Nagaur district

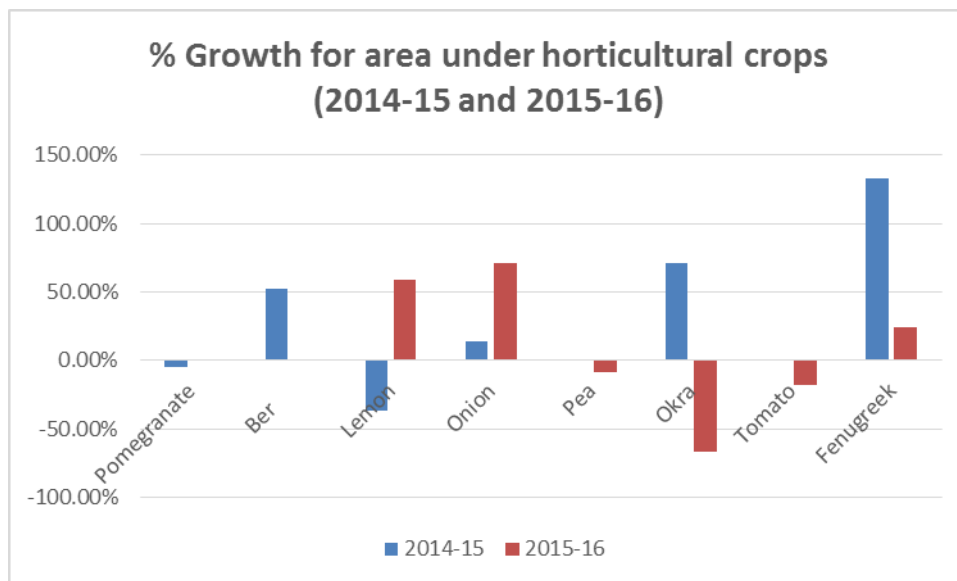
The horticultural crops like Onion, Pea, Okra & Tomato crops in vegetable crops and Pomegranate, Lemon and Ber in fruit crops are suitable for the area. Therefore, horticultural crops have to be promoted through crop demonstrations in the area in the benefit of farmers of the cluster. On the basis of data from the year 2011-2015-16 available with the horticulture department, a comparison of State as well Nagaur district is being made next page.

The concerned table (Refer Annexure 2.5) clearly reveals that the area is increasing in almost all the crops except Ber (0.001%) & Okra (0.002%) in state over last 5 years. Likewise, similar pattern can be seen in district. This increasing trend is not upto the satisfaction and it can be interpreted, the desired effort towards promotion of horticultural crops is strongly needed in the state as well as in the district. Irrigation water is limiting factor out of the various reasons for not increasing area under horticultural crops. The approach being adopted under the project may be a game changer in this field. The increasing trend ranges from 0.001% to 0.547% in the district.

The area under horticultural crops ranges from 0.36% to 15.71%. The area under Onion is 15.71% over the state average followed by Pea, Ber, Fenugreek, Pomegranate, Lemon, and Tomato. It means the crops being grown in the district are important crops of the cluster.

Looking to the scope of marketing, potential, technical knowhow and available options in the project, there is immense opportunity to increase area under horticultural crops. Hence effort has to be made to enhance the area under horticultural crops in the cluster so that the economic condition of selected farmers can be uplifted. A set of intervention has to be demonstrated in the area to link the farmers with the project to achieve the project development objectives.

Figure 4: Percentage growth for area under horticulture crops (2014-15 and 2015-16)



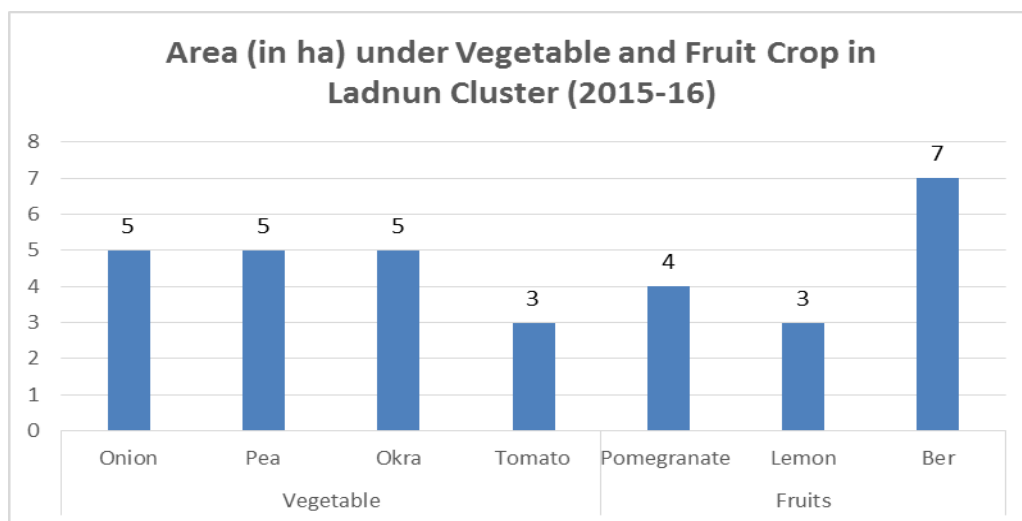
(Source: Data Analysis ABPF)

Crop wise area of Horticultural crops in Ladnun Cluster

Before going to finalize the proposed area of horticultural crops in the selected cluster of Ladnun, the area of horticultural crops in the cluster has to be discussed. A field survey has been conducted in the project cluster to assess the area under horticultural crops and it was found that there was no significant area under these crops during the year 2015-16. Therefore, whatever area has been reported under these crops is being summarized in Annexure 2.6

The data (Refer Annexure 2.6) clearly shows that reported area under horticultural crops is only 0.26% of the total agriculture land (12434.61 ha) but there is a scope to increase the area under these crops i.e. (vegetables: Onion, Pea, Okra & Tomato and fruits crops Pomegranate, lemon & Ber) by diversification of area from food grain crops to the horticultural crops. By this way some upliftment of economic level of farmers of the cluster could be done.

Figure 5: Area under horticultural crops in Ladnun Cluster (2015-16)



(Source: Data analysis by ABPF)

2.4.3. Crop Water Requirement in Ladnun Cluster

The Crop Water Requirement of crops being grown in the Ladnun cluster is being summarized in Annexure 2.13. The data shows that due to implementation of moisture conservation and rainwater harvesting activities, the total cropped area is proposed to be increased from 12371.03 ha to 13243.72 ha, it means 855.69 ha more area is to be made available for cultivation. Out of this an area of 526.17 ha is to be increased in Kharif and an area of 329.52 ha is to be increased under Rabi and horticultural crops.

The crop water requirement Kharif crops is 10219799 cum, which would be met out from in-situ moisture conservation in arable area. There is total crop water requirement of Rabi & horticultural crops are 9986915 cum. It is also significant to mention here that in such index catchment areas almost 50% Rabi crops are grown on conserved moisture, means only 25% crop water requirement of Rabi & horticulture crops will be taken from ground water in the cluster. In addition, if demand side water application methods are adopted on each and every wells/tube wells, about 50% of total water requirement may be saved out of total crop water requirement in Rabi & horticultural crops, it means total 2.74 MCM crop water will be met out from the ground water and water will be harvested through different measures to be done in the cluster.

2.4.3.1. Drinking Water Requirement

The water requirement of human being, animals, birds etc. will also be met out from the cluster. The total of such water requirement is being summarized as under:

Table 9: Requirement of drinking water in project area

S. No.	Particular	Nos.	Per day requirement (in litre)	Total Requirement (in litre)
1	Human	55279	40	2211160
2	Big animal	8753	30	262590
3	Small animal	20599	15	308959
4	Birds	3158	0.15	473.70
Total (in litres) Day				2783208.70
Per year Requirement of drinking water (in litres)				1015871176
Per year Requirement of drinking water (in cum)				1015871

(Source: DPR, WDSC, Ladnun)

Above table reveals that the estimated total water requirement for human beings, animals & birds etc. is 1.01 MCM cum.

2.4.3.2. Water Budgeting and Water Balance

Based on the above data, the ground water level is decreasing at the rate of at the rate of 0.86 m per year and currently 4.21 MCM is being drafted for agriculture use and 1.93 MCM for domestic use. Total ground water is available 4.23 MCM annually in the cluster and the total draft has to be reduced to 2.29 MCM for maintaining water balance in the cluster

The entire Project Area was categorised based on the nature and characteristics of the area. Total catchment area is 14527 ha and annual average rainfall is 413 mm of the area. Based on the catchment area and annual average rainfall, the total yield of the rainfall will be about 60 MCM (simple formula used area x average rainfall). As per ground water study about 6-18% of rains contribute ground water, which depend type of catchment, formation, intensity & quantity of rainfall etc. Bansur cluster is under Average to bad catchment and its formation is older alluvium

and rainfall is also good in the area so about 18% of rainfall, which contribute to the ground water. It means 10.80 MCM rainwater will contribute ground water. In addition, soil moisture would also be available repeatedly and fulfil the crop water requirement of Kharif crops. As discussed elsewhere, the adoption of Micro Irrigation System (MIS) can save about 50% of crop water demand. The field and horticulture crops being grown in Rabi season are depend on conserved moisture and ground water. It means 50% ground water may be saved through cultivation on conserved moisture and about 50 of ground water can be saved through adoption of MIS. It is also discussed elsewhere that total 4.23 MCM of ground water is available annually in the cluster and the total draft has to be reduced to 2.29 MCM for maintaining water balance in the cluster. The crop water requirement and need of the ground water may be summarized as hereunder to maintain the water balance in the cluster:

Table 10: Crop water requirement and need of the ground water

S. No.	Items	Crop Water Requirement (MCM)	Total Ground Water to be Save due to Various Measures (MCM)/ cultivation on conserved moisture	Net crop water requirement to fulfilled from ground water (MCM)
1.	Crop water requirement of Kharif crops	10.22	10.22	0.00
2.	Crop water requirement of Rabi crops	8.90	4.45 (Conserved moisture) and 2.23 (MIS)	2.23
3.	Crop water requirement of Horticultural crops	0.99	0.495	0.495
5.	Domestic & drinking water requirement	1.01	0	1.01
	Total	21.12	17.395	3.735

Since 413 mm is average rainfall in the area and total area of the cluster is 14527 ha so total 60 MCM rains received during the monsoon in this cluster, whereas total 0.08 MCM is proposed to be harvested through tankas, nadies in addition to in-situ moisture conservation. It clearly shows that Kharif can be grown with in – situ moisture conservation and as mentioned above, about 50% crops of Rabi season are grown with conserved moisture. It means the crop water requirement of Rabi crops may be reduced to 50%. Keeping in view, 100% area is covered under micro irrigation system the final crop water requirement would be about 3.735 MCM which would be drafted from ground water against 4.23 MCM available as per the ground water study.

Based on the fact, there is still need for promotion of such demand side measures in the cluster so that ground water should not be further exploited.

2.4.4. Seed Replacement Rate (SRR) in Ladnun cluster:

2.4.4.1. Seed Replacement Rate (SRR) in the State & in District:

The status of Seed Distribution and Seed Replacement Rate in the State & District has to be discussed with reference to the project area i.e. Ladnun cluster. The status of Seed Distribution and Seed Replacement Rate in the State & District is being summarized in Annexure 2.9. Pearl Millet in Kharif and Isabgol & Mustard crops in Rabi season The seed replacement rate (SRR) in almost all the crops is lower than the state average in almost all the crops which ranges from 0% to 79.39% in the year 2013-14 whereas in the year 2014-15, repeating trend was seen in all the crops, ranges from 0% to 81.72%. The SRR of the district is lower than the state average except Sesamum and Wheat crops where SRR is higher than the state average during the year 2014-15. During the year 2014-15 the SRR in Sesamum is 71.67% against the state average of 36.27% and similarly in Wheat crop it is 36.12 against the state average of 32.63%.

It indicates that in almost all the crops the SRR is less than what it should be. To increase the productivity of these crops the SRR has to be increased. Therefore, certified seed of high yielding varieties have to be sown in all the crops. Therefore, it is an important activity for getting optimum desired productivity in the years to come in the district.

2.4.4.2. Seed Replacement Rate (SRR) in Ladnun cluster:

During the field survey, it was observed that the Seed Replacement Rate (SRR) in Ladnun cluster is almost the same as the SRR of the district. It means the focus is to be given on adoption of certified seed and high yielding varieties which are having disease & insect-pest resistance, have higher economic & commercial value in view of the storage capacity & marketing linkages and/or value chains.

The status of Fertilizer Consumption in Terms of Nutrients in State & District:

The consumption of fertilizers for the supply of nutrients is very significant to increase the productivity. But at the same time it is very necessary that they should be used judiciously in the crops. Integrated Nutrient Management (INM) is also important in the production sector. The department has also finalized the package of practices for adoption of INM in crop production. The current status of fertilizer consumption in terms of nutrients is being discussed here as used in the state as well as in the district. The current status of Fertilizer Consumption in Terms of Nutrients during 2014-15 (In Lac Tons) is being summarized under:

Table 11: Current status of Fertilizer Consumption in Terms of Nutrients during 2014-15 (In Lac Tons)

State/District- Nagaur	Nitrogenous (N)			Phosphate (P)			Potashic (K)			Total Fertilizer in terms of NPK			Per ha Fertilizer Consumed (Kg/ha)		
	K	R	T	K	R	T	K	R	T	K	R	T	K	R	T
Rajasthan	3.47	6.06	9.53	1.75	1.56	3.31	0.063	0.088	0.15	5.28	7.7	12.98	34.4	82.76	52.64
District	0.12	0.18	0.3	0.07	0.08	0.15	0.002	0.007	0.009	0.19	0.27	0.46	16.31	81.37	30.62

(K – Kharif, R – Rabi & T – Total)

(Source: Agriculture Department, Ladnun)

Above table reveals that average consumption of fertilizers in the district in Kharif is very low which is only 47% of the state average & in Rabi seasons, it is only 1.39Kg/ha lower than the state average. In totality the consumption of fertilizers in the district is 22.02 Kg/ha lower than the state average. The judicious use of fertilizers is now needed & the farmers have to be promoted to adopt package of practices and the apply fertilizers in the crops judiciously.

The Area Covered and Technical Grade Material (TGM) used under Plant Protection Measures in State & District:

The aspect of adoption of plant protection measures in the crop production is of paramount importance. Although the use of plant protection measures is not healthy in term of human health but optimum level of production is also need of the time. While adoption of plant protection measures, the Integrated Pest Management has to be kept in mind and accordingly package of practices for IPM has to be adopted at the time crop production in Agricultural as well as Horticultural crops.

Here the current status of seed treatment, soil treatment, poly treatment, intensive treatment, rat & weed control etc. is being summarized in Annexure 2.12.

The Annexure 2.12 indicates that the seed treatment, soil treatment, poly treatment, intensive treatment, rat & weed control etc. is being adopted in lower area than the state average. So adoption of the package of practices needs further improvement in a big way keeping in view the Integrated Pest Management (IPM) so that crop production can be increased without effecting environmental impact.

The Area Covered and Technical Grade Material (TGM) used under Plant Protection Measures in Ladnun Cluster:

During the field survey, it was observed that the area covered and technical grade material (TGM) used under Plant Protection Measures in Ladnun cluster is almost the same as per the district. It means the focus is to be given on adoption of package of practices for enhancing the area to be covered and technical grade material (TGM) used under Plant Protection Measures keeping in view IPM and high yielding varieties which are having disease & insect-pest resistance and, have higher economic & commercial value in view of the storage capacity & marketing linkages and/or value chain.

The Crop-wise Area Covered and Technical Grade Material (TGM) used under Plant Protection Measures in the State & District:

The crop wise area covered and technical grad material (TGM) used under plant protection measures in the crop production is very important factor to keep the productivity optimum. But excess use of chemicals is threat to the health, so IPM has to be kept in mind in the process of crop production and very careful use of plant protection measures are to be adopted in crop production.

The crop wise area covered and technical grad material (TGM) used under plant protection measures in the state and district is being summarized in Annexure 2.11

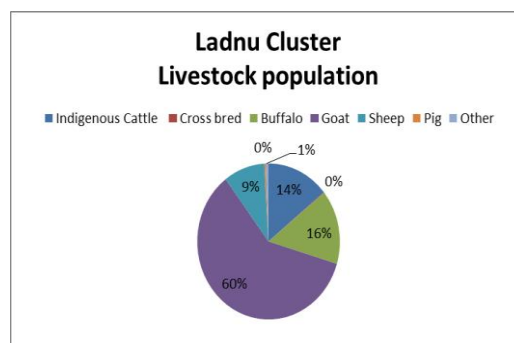
The table (Refer Annexure 2.11) indicates that the crop wise area covered and technical grade material (TGM) used under plant protection measures is less than the optimum level in the state as well in the district. It means that the adoption of package of practices is not being done at the optimum level. So, further improvement is needed in a big way keeping in view the Integrated Pest Management (IPM) so that crop production can be increased without effecting environmental impact.

The Area Covered and Technical Grade Material (TGM) used under Plant Protection Measures in Ladnun Cluster:

Likewise the data for Ladnun cluster is available at the movement. During the field survey, it was observed that the crop wise area covered and technical grade material (TGM) used under Plant Protection Measures in Ladnun cluster is almost the same as per the district. It means the focus is to be given on adoption of package of practices for enhancing the crop wise area to be covered and technical grade material (TGM) used under Plant Protection Measures keeping in view IPM and high yielding varieties which are having disease & insect-pest resistance and have higher economic & commercial value in view of the storage capacity & marketing linkages and / or value chains.

2.5. Livestock profile of Ladnun Cluster

In the Ladnun cluster large no of households possess cattle, buffalo, goats and sheeps. The district milk union collects around 18,000-20,000 liters of milk per day. However, the network is not that strong in the cluster area. Nagaur and Ladnun are on the breeding tract of Sirohi goat breed and important sourcing place for quality goats. The household wise livestock profile of the cluster is given in Annexure 2.16 as per the Livestock



Census 2012. Livestock Profile of Ladnun cluster shows high population of the goats (60%), most of indeginius variety among all cattle population of the cluster. This signifies the importance of goat rearing for livelihood security of the farmers in the cluster. The small holders of the cluster prefer to keep animals with low resource requirements. So there is the scope of popularising goat farming with suitable interventions for improving milk and meat productivity. Project intervention will also support small holders to collectively market breeding animals to institutional buyers. Goat rearing serves as a secondary source of livelihood for many farmers in the cluster.

The cluster has 20 goat specific MTGs and around 4542 families own 17753 goats, averaging around 4 goats per goat rearing family. The village wise data for Goat population segregated further into male, female, calved etc. is in Annexure 2.17

As evident from the above data, Goat rearing is quite popular in this area, and there is a significant scope of the value chain of goat meat.

2.6. Structural characteristics

The Ladnun cluster is located in Nagaur district. The district has a number of industrial areas like Nagaur (IID), 28 A Mundwa (ACL), RIICO I.A MERTA City, RIICO I.A Makrana Didwana, Prabhatsar GC, Prabhatsar GC, Extn. (source: MSME Development Institute, “Brief industrial profile of Nagaur district”). Apparently there are over 8165 registered SME and 4781 MSME unit in the district. One of the leading processor in the region is Sarvotam Agro Industries Haripur they are into soya meal and soya cakes respectively. Some of the supporting institutions and service providers supporting processing units with region are given in the Annexure 2.15

Presently, the structural infrastructure in the Ladnun cluster that may influence Agri business activities in the clusters is as under:

2.5.1. Government departments

There is presence of Agriculture, horticulture, animal husbandry and watershed development & soil conservation departments. These departments have head office in Jaipur but they have offices at district level too.

2.5.2. APMCs

Ladnun cluster has 5 APMCs, which can have impact on the cluster.

- a. Deedwana, 34 kms from the cluster
- b. Degana , 106 kms from the cluster
- c. Kuchaman, 80 kms from the cluster
- d. Merta, 154 kms from the cluster
- e. Nagaur, 90 kms from the cluster.

Farmers sell their produce mostly in Nagaur main APMC irrespective of the season or type of crop. In some cases, village level traders also approach and buy the produce at farm gate itself.

2.5.3. Warehouses

Sr.no.	Name of Warehouse	Capacity
1	Central warehouse corporation	35,494 MT

2.5.4. e- Markets

We are currently witnessing the transition to online marketing for various marketing activities involved in agriculture business. Government has taken various initiatives to introduce trading platforms for the support of agriculture business. As of now no e-markets are available in the cluster.

2.5.5. Predominant practices for cultivation

Following are the predominant practices being carried out in the Ladnun cluster with regard to the purchase of inputs, crop cultivation and transport of harvested produce-

Sr.no	Particulars	Present Practice
1	Seeds/Fertilizers	Local Input Shops
2	Fungicide & Pesticide	Local Input Shops
3	Land Preparation and other cultivation practices	Local Labour and own/hired tractors/implements
2	Harvesting and farm level grading	Combine Harvesters
3	Transport	Pick up vans/Tractor Trolleys/Bullock carts
4	Credit	Traders provide facilities, credit facilities with interest.
5	Marketing	Local Traders
6	Packaging	Processors- Cleaned and grade and packages it in 30 Kg Bags for Retailing

Chapter – 3: Strategic context and rationale for selecting value chains in cluster

3.1. Parameters for selection of Value Chain crops

A scoring matrix consisting of the parameters along with their weightage has been designed for prioritisation and selection of commodities for value chain intervention in the cluster (Annexure 3.1). Broadly, there are four different types of parameter categories with different weights based upon which the crops have been scored. Green gram (Moong), Bajra, Guar, Wheat, Mustard and Isabgol are the major crops from the cluster that have been considered and compared using this scoring parameter. (Annexure 3.2)

3.1.1. Existing size of the crops

The first category of parameters may be broadly categorised under with respect to existing size of crops in the cluster with regard to their area under cultivation, production and average cluster level productivity relative to national average productivity. Bajra and Green gram score the highest in this category as they have maximum cropped area followed by Isabgol. In terms of production, Bajra is the highest followed by Green gram and Wheat. When it comes to relative productivity of the crops in the cluster, all crops have higher productivity when compared to their respective national average productivity. (Annexure 3.2)

3.1.2. Potential for Value addition

The second category of parameters may be broadly categorised under the potential for value addition to the crops of the cluster, implying scope for increased value addition for local producers and processors and higher margin realization for producers. The typically processed value added products of each crop have been considered for estimating the retail level price spread. In order to maintain parity among these crops for their different value added products, the yield loss at processing level has been considered in cases where significant to get the actual required raw material to prepare the end product. For instance, the yield loss in case of Isabgol husk, it has been considered as 70% while that for roasted Green gram, is taken as 25% respectively. Yield loss has been taken as 10% in case of roasted Bajra and Wheat while 30% for Guar gum followed by 60% in Mustard oil. Thus, Isabgol scores the highest in the price spread at retail level as Isabgol has retail price spread of Rs. 66,667/- which is based upon its market value of Rs. 200 per 200g and gross realization of farm at Rs. 100 per kg. Roasted Bajra and Guar gum follow Isabgol in this parameter.

In the parameter related to price spread between farmer's gross realization at the farm and price paid by the primary processor at mandi, a margin of 4% has been considered as measure of price spread, over and above the prevalent mandi prices of the crops after consultation with traders and processors. Isabgol scores highest with around Rs. 400 per quintal followed by Green gram with Rs. 160 per Quintal. This parameter signifies the small scope to get this margin transferred to farmers through relevant value chain interventions in the crops such as through establishment of primary processing FCSCs and reduction in mandi fees.

Net profit in production per acre is the measure of direct returns to farmers by selling the crop in the mandi and fodder locally without any value addition. The fodder yield for Wheat, Green gram

and Guar is almost equal, that is 5 Qtl/acre. While fodder yield of Mustard is lowest with 4 Qtl/acre, it is of better quality and hence gets better return in market. Overall, Isabgol gets highest score in the net profit realization while Green gram gets the lowest.

The next parameter is on scope for processing in the state of Rajasthan, there are comparatively more number of secondary and tertiary processing units of Mustard like Adani Wilmar, Dhara and other private players in the state. Although wheat has multiple private flour mills and cleaning and grading units, it lacks nevertheless in high end technologically advance processing units which could yield refined and high quality end products. Same is the case of Green Gram. In the case of Guar and Isabgol, there are multiple primary and secondary processing units but their produce acts as the raw material in other derivatives industry.

The parameter regarding the number of value added products of the crop considers the scope for locally feasible value addition at the primary level, secondary level, tertiary level and above such that higher the degree of value addition, higher are the returns. Among these crops, Wheat has the highest number of value added products viz. wheat grains, flour, *sooji* and other bakery products are the value added products. Next come Mustard, Green gram and Bajra with 3 value added products. Isabgol and Guar have only 2 value added products i.e. Guar gum and guar korma used in making feed and Isabgol husk and cattle feed from Isabgol.

In order to quantify the parameters of growth in market demand, the national growth rate of consumption has been calculated (as CAGR) for each commodity and equated against its market demand. It is highest for Guar (8%) followed by pulses (5.05%), then Wheat (3.06). (Annexure 3.5)

3.1.3. Risk assessment of Potential Value Chain crops

The third category of parameter is regarding identifying the risk in the respective value chain of the crops of the cluster. Price volatility in the historical mandi prices of the respective commodity over the period of 3 years has been taken as the benchmark for capturing and measuring the risk in the commodities due to any adverse agronomic circumstances like drought, pest epidemic, bumper production and/or international market prices crash/upsurge. The price volatility is highest in case of Green gram (37.20%) and Bajra (34.29%) while Guar, Mustard and Wheat have the lowest price volatility at 28%. Green gram has scored highest in this category as it has highest scope for value chain intervention in order to curb the price volatility and thus, ensure sustained regular income to the farmers. (Annexure 3.2)

3.1.4. Environmental Parameter

In the next category for environmental parameter with respect to water intensiveness of the crop, the water requirement of every crop has been compared with each other. The crop with lowest water requirement is scored highest as it proposes highest scope for crop diversification in order to conserve water in the cluster. Importantly, Bajra, Green gram and Guar with lowest water requirement of 1000 cum/ha have the highest scope for crop diversification followed by Mustard and Isabgol with that of 2500 cum/ha and 3000 cum/ha. Wheat has the most water requirement of 4000 cum/ha, making it least preferred for crop diversification. (Annexure 3.2)

3.2. Inference from the Scoring Matrix

It could be concluded from the total scores of the matrix that Bajra is the most important value chain crop in the matrix. It has the highest cropped area and the highest production in the cluster. It has a good scope at mandi but the scope for value addition and processing in the state is average. It is the major crop of Kharif with almost the highest volatility in price for past 3 years hence it has maximum scope for intervention to stabilise the price in turn benefitting the farmers along with least water requirement.

Second highest scoring crop is Green gram as per the matrix, for which the major reason is it has the second highest cropped area and production and the least crop water requirement similar to Bajra. Potential for value addition is above average in Green gram based on the fact that the crop has not much scope for value addition and processing in the state.

Although as per the scoring matrix the third highest scoring crop in value chain intervention is Guar but based on the discussion with the PMU officials Isabgol is present in only of the clusters which itself has a high potential for value addition should be taken as the third crop for value chain intervention.

3.2. Current marketing chain of selected value chain crops

Present condition of overall value chain of selected commodities has been ascertained and formulated with the help of site visits and interaction with producers and related stakeholders. The questionnaire schedules can be referred in Annexures 3, 4, and 5. With support of the production analysis made in the earlier chapter, an attempt is made to arrive at the value added activities and value added products that could substantially add values. (Annexure 3.3)

Bajra

The pre-intervention value chain for bajra involves basically two production-distribution or activity-marketing channels, namely one related to food processors and the other related to feed processors. Presently, village traders and the mandi largely facilitate aggregation of produce. Producers suffer from want of storage and grading and sorting facilities and value accruals are limited. (Annexure 3.3)

Typically, the gross yield enjoyed by producers is barely 11.2 quintals per acre. Gross value realisation on sale at Rs.1400 per quintal is Rs.15, 680 per acre. The cost of cultivation is about Rs.7, 840 per acre and the net value realisation is about Rs.7, 840 per acre. (Annexure 3.6)

Green gram

The pre-intervention value chain for Green gram involves basically two production-distribution or activity-marketing channels, namely one related to food processors and the other related to feed processors. Presently, village traders and the mandi largely facilitate aggregation of produce. Producers suffer from want of storage and grading and sorting facilities and value accruals are limited. (Annexure 3.3)

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Isabgol

The pre intervention value chain of Isabgol has essentially three channels. Though farmers sell the seed either in the local mandi or to the village level traders, eventually, all stock find their way to Unjha mandi, Gujarat from where they are taken by processors. From here, the channel divides into three parts. The 1st part is for domestic markets where pharma/healthcare companies take the Isabgol either from the processor directly or through distributors and sell it in their branded and packaged form. The 2nd channel ends up with export market which is eventually 90% of the total market share of production. Both the processors and distributors engage in export of Isabgol. The third channel is basically of the animal feed sector, where the animal feed processors take the balance part of the seed to use as animal feed. They again distribute it through their channel after mixing with other feed materials. (Annexure 3.3)

Typically, the gross yield enjoyed by producers in Isabgol is 4.08 quintals per acre. Gross value realisation on sale at Rs.10, 000 per quintal is Rs.32, 800 per acre. The cost of cultivation is about Rs.8, 000 per acre and the net value realisation is about Rs.32, 800 per acre. (Annexure 3.6)

3.4. Strategic context of Goat Value chain in Ladnu cluster

3.4.1. Goat for milk production

The goat farmers mostly consume the milk from these goats domestically, apart from selling live animals. Many families also sell excess milk in the village at the rate of Rs 10 - 12/L in the dairy Cooperative mixing with Cow/Buffalo milk as there is currently no separate channel available for goat milk collection. This provides handy daily income during the milking cycle of these goats.

Goats however produce far lesser quantity of milk compared to large ruminants. However goats start to produce 2-3 years earlier, and have considerably lower cost of production for both feed and water, and there are no limitations for slaughter of non-productive animals. Among the breeds of goats in the cluster, some of important milk production traits noted in field areas have been as follows-

Table 12: Productivity trend of goat milk in the cluster

Average daily milk production (Wet average)	500 ml to 1 liter (Range 250 ml to 3 Liter)
Lactation length	150 to 170 days (5 to 6 months)
Estimated lactation yield - Dry period 3 to 4 months	100 to 180 liters

Source: Department of AH

The cluster has a total of around 17753 goats out of which 34% are milking animals. The estimated milk yield would be around 15305 L/day at an average estimated yield of around 2.5 L per day in two milking. Out of this, if 1 L of milk per day per farmer is taken as marketable surplus, it can be estimated that around 6122 L per day is the potential for collection as on date and this can grow up to 15305 L/day if maximum potential is achieved by developing a separate remunerative value chain for Goat milk. The nearest markets could be Ajmer and Jaipur. However, the Goat milk collection and other value addition can be seen as a pilot and initially one Chilling centre of 500 L capacity can be established to see the response.(ref Annexure 3.3)

3.4.1. Goat for meat production

The market linkage for live goats poses difficulties, as it is highly informal and the cluster is located at a long distance from the major markets like Jaipur, Delhi and Mumbai. Breeders sell to traders who take animals to larger terminal markets out of the state (the main ones being Delhi and Mumbai) or to smaller markets near cities. Traders are an organized group called Khatiks and look out for each other. They are an extremely tight community and make good profits from buying and selling livestock. This means it is not possible to eliminate them as middlemen, and the best option is to ensure fair prices are paid to the breeders. There is a ban on opening slaughterhouses in the state, which means the possibilities for value addition are almost non-existent. Otherwise, animals have to be brought live out of the state. Transportation costs for these movements are high, but traders who buy locally can organize themselves in groups to transport animals. (ref Annexure 3.3)

Major constraints in goat value chain in the cluster:

The process of goat selling and buying though deeply associated with the weight of the animal; do not involve any weighing of animals. • Goat rearers sell male goat and old female goats to traders visiting from nearby cities and town. The price of the animal is quoted by the trader first (on visual estimate) and not by the goat rearers.. • Rearers are unaware of the live weights of the animals and fail to correlate the price of the sale with the live weight of the animal. Meat equivalent to 50-60% weight of the animal (depends on age and feed intake) can be obtained from the animal. Social taboo of meat handling also keeps the rearers uninterested. • Rearers have a tendency to sell off their male stocks at an early age. Fear of mortality and losses instigate rearers to sell off the male stocks early. Lack of proper knowledge on efficient and good animal management is generally absent, which increases mortality. • Old female goats are also sold off at very low prices for meat purposes. These goats are used for Defence Cantonment supplies as well as consumption in block/district level meat shops. The Defence Supplies generally go at very low tender rates (Rs 40-50 per kg) where supplying male goats is not viable for the supplier. • All goat parts have commercial value. Goat wool is sold at Rs 10-12 per kg to local traders who supply it to carpet industry in UP, Haryana and within Rajasthan. The skin of the animal is valued at Rs 70-80 per piece and the head for Rs 100.

Factors affecting sale price of goat by farmers:

i) Rearers also end up selling animals at a wrong time due to cash crunch. Generally business planning of selling animals in the festive seasons of Eid is absent. ii) Deciding the quantity of saleable meat in the goat. On an average the quantity of meat is found to be 50 to 60 % of the live

weight of the animal, iii) the look and health of the animals. A sick animal will fetch a very low price. iv) The season and time of the year. Especially during Eid, animals fetch better prices. At this time goats are not judged by the above-mentioned points but by the sacrificial value of the animal. Although sick and imperfect animals are not sacrificed, some animals can fetch a fortune if it has certain religious marks like a star or a half moon etc. on its body.

Illustration of an organized market for goats in nearby district: Jodhpur Bakra Mandi

Bakra (goat) Mandi is held daily in Jodhpur city at Sivansi Gate area from 3 pm onwards till the sunset. Around 30-40 traders assemble here and bring goats from a catchment area of 250km radius. Local traders take a four wheel vehicle and roam around in villages to procure goats and sell the goats in goat mandi the same day or the next day. Around 100 local retailers and bulk buyers attend the goat mandi and procure goats. Some bulk buyers collect goats and sell to far off markets at Delhi, Bombay, Jaipur and Hyderabad. Local traders also participate in tender floated by the defence department which has base in Jodhpur and Jaisalmer districts. It is mandatory for every new goat trader to get a certificate from a local administration (municipality).

An illustration of an un-organized bakra mandi in front of Idgah, Delhi road, Jaipur:

Hundreds of sellers from nearby places come to come here to put their goats on sale at Bakra Mandi. The mandi is held every year before the Muslim festival of Eid-Ul-Zuha. From the customers' point of view, health, price and other features of a goat matter a lot. So it becomes a prestige issue for the people who sacrifice goats on Eid. Goats below one year of age are not sold in the market as they cannot be sacrificed on Eid-Ul-Zuha. A 13-month-old goat usually has two teeth and an 18-month-old goat has four teeth. People like to buy a goat that has two teeth. There are many other features like colour, health and signs on the body that make the price of a goat high. A goat having natural signs of Islam religion sells with best price.

3.4.2. Fodder Requirement of Ladnun cluster

The data given in the, Annexure 3.7 indicates the fodder requirement of livestock population of Ladnun cluster at 31471 MT. It has to be fulfilled from the fodder to be produced in the cluster and if there is some gap, then two current measures have to be followed, one is to increase production within the cluster through promoting cultivation practices and second is to import from the area outside the cluster.

Fodder availability in Ladnun Cluster

The table presented above reveals the estimated total requirement of dry matter (Fodder) is 34147 M.T. against the fodder availability 34922 MT which is matching the requirement. (Refer Annexure 3.7)

Chapter – 4: Key opportunities and challenges in selected value chain crops

4.1. Opportunities and challenges

(A) Looking at the cropping pattern, production, etc., the following crops have been selected for value chains study/diagnostics.

#	Season/Type	Crop
1	Kharif	Green gram, Bajra
2	Rabi	Isabgol

(B) The SWOT of key commodities reflects gaps in terms of storage and primary processing facilities, large number of intermediaries in the chain, limited market information on processing activities, limited support from financial institutions for producers and/or their networks etc.

The SWOT of the key commodities/crops as per value chain study is as follows:

4.1.1. Bajra

Bajra is a major Rabi crop grown in Ladnun cluster. Bajra is mainly grown for cattle feed and flour purpose.

Strength	Weakness
<ul style="list-style-type: none"> Bajra is one of the most extensively cultivated cereals in the world, after rice, wheat, and sorghum In India alone, 90% of the world's and in Rajasthan 45 % of country's total bajra is grown. Its tolerance to drought, heat and soil salinity along with its higher water use efficiency makes it a climate-smart crop. It performs better than cereals in semi-arid regions. It gives sufficient energy to the field workers at a very low cost. Thus it is called Poorman's food'. It is rich in nutrients like iron and zinc apart from carbohydrate and protein. It provides feed to large number of animals and grown for silage and hay purpose also. 	<ul style="list-style-type: none"> Bajra flour (prepared by pounding or milling) quickly goes rancid, and can be stored only for short periods. It tastes bitter due to the presence of phenolic compounds Limited processing units for bajra and its by-products such as flour units, roasted Bajra units, etc. Inadequate grading & sorting facilities. The production of the crop is seasonal, but its demand remains for a longer period. Thus, adequate storage facilities required. Large number of intermediaries in the chain leads to low producer's income. Lack of market information regarding prevailing prices, arrivals etc. force farmers to sell in village itself.
Opportunity	Threat

<ul style="list-style-type: none"> • Scope for tie up of FPOs through CFC with firms like VSR, Patanjali, Moraraka Organic, etc. • Scope for facilitation of start-ups from amongst FPOs or individual entrepreneurs, in secondary processing of value added products of Bajra like flour, snacks, animal feed, roasted bajra, etc. • Scope for establishment of quality sorting and grading facilities by FPOs as part of Farmers Common Service Centre (FCSC), along with facilities for packaging and vehicle to facilitate transportation. • Promote good agricultural practices with regard to planting, harvesting, use of inputs, disease management, pest control, etc. through FCSC • FPOs to undertake joint input sourcing activities for seeds, fertilizers, pesticides, etc. under the umbrella of CFC • Increasing use as roasted bajra and in malt shows better marketing opportunities 	<ul style="list-style-type: none"> • Adverse climatic condition can impact the crop production and productivity • Bird damage at the time of grain filling and maturity also lower the production considerably • Lack of higher remuneration in bajra may reduce farmer's interest from cultivating it.
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4.1.2. Green Gram

Green Gram is a major Kharif crop grown in Ladnun cluster. Green Gram is consumed in the form of whole pulse as well as split pulse. It also helps control blood pressure, lose weight and is a good source of fibre and iron.

Strength	Weakness
<ul style="list-style-type: none"> • India is the world's largest producer as well as consumer of green gram. • It produces about 1.5 to 2.0 million tons of Mung annually from about 3 to 4 million hectares of area, with an average productivity of 500kg per hectare. • Green gram output accounts for about 10-12% of total pulse production in the country. • Mung production in the country is largely concentrated in five states viz, Rajasthan, Maharashtra, Andhra Pradesh, Gujarat and Bihar which together contribute to about 70% of total Mung production in the country. • Rajasthan and Maharashtra occupy the first two positions, contributing over 45% of green gram production in the country. • Mung contains about 20-25% protein. • The plants are sometimes cut and ploughed into the soil to enrich soil nitrogen. • Various products are marketed mung, mung dal chilka, mung dal whole etc. • Large scope of innovation in terms of noodles/pasta, RTE Dal Khichdi etc. • Mung Besan flour is considered high in fiber and protein and is easy to digest 	<ul style="list-style-type: none"> • Green gram productivity is less • India is a net importer of Mung. Imports are mainly sourced from Myanmar to meet the domestic demand. These imports have been hovering from around 0.5 to 1.5 lakh tonnes during the past few years. • Traditional package of practices in cultivation of Green gram • Still Cultivated on marginal and degraded lands with more than 87 % of the area being under rain fed conditions. • Limited identification efforts for farmer leaders (entrepreneurs) and BOD at field level in Green gram Value Chain for capacity building • Banks do not support individual farmers for crop loans etc. • High dirt content in harvested green gram • During good harvest prices may collapse and may lead to distress sale • Processors lack awareness about special purchase license option to source directly from farmers /FPOs. • No well-defined mechanism for procurement and marketing of green gram as is the case with Paddy or Wheat. • Inadequate links between farmers and millers for direct procurement. • Inadequate capacity building programs on Market led extension services. • Mung bean is difficult to mill pulse • Loss in form of broken and powder is high

Opportunities	Threat
<ul style="list-style-type: none"> • Option for intercropping in rainfed areas with sugarcane. • With growing demand for dal there is large scope for start-ups to be facilitated among the farmers of the PCs or individuals. Good processing opportunities for green gram value addition includes production of- dal, flour, snacks, namkeen • Productivity can be increased by development of improved varieties of seeds which can withstand weather aberrations like pest attacks etc. • Farmer can be made aware of the modern production technologies • Provision of cleaning grading pulse processing mills and other facilities like storage for farmers through the FCSC • Development of alternate marketing channels for green gram procurement • In terms of direct supply to SME and large processors, there is a scope to tie up with green gram producing farmers via FCSC to the big market players like Patanjali and Dal mill associations/ MSME • Large scope of contract farming, buy back contracts, participation in traders etc. 	<ul style="list-style-type: none"> • Low productivity may reduce farmers' interest to produce green gram. • Natural calamity may impact production and hence productivity and profitability may decline. • Taxation related policies (for example-proposed 5% GST on branded goods), liberal imports etc. affects the price levels. • Processors operate on low profit margins and are also exposed to high speculations of prices in market also in increasing the probability of sickness.

4.1.3. Isabgol

Strength	Weakness
<ul style="list-style-type: none"> • Isabgol is a high value medicinal crop • India is the leading producer as well as exporter of Isabgol seed and Husk • The semi-arid weather of Rajasthan is highly suitable for Isabgol cultivation • High potential of value addition • Widely consumed for different gastro-remedies across the world • Has a good demand in India also • 90% of the produce from India is exported 	<ul style="list-style-type: none"> • Scanty and erratic rainfall • 75 per cent area is rain-fed • High cost of inputs, labor • Non availability of community infrastructure • Rajasthan has no major mandi for Isabgol. All stock eventually goes to Unjha mandi, Gujarat • Harvest needs to be kept safe from humidity • Farmers do not apply good agriculture practices • High price volatility in case of bad weather
Opportunities	Threat
<ul style="list-style-type: none"> • Extension support through RACP may enhance productivity • Scope of establishing FPC for Isabgol farmers • Scope of establishing primary sorting/grading/storage of seeds by FPC for direct trade with processors • Scope of establishing de-husking unit by FCSC through FPC will increase earning potential for farmers • Scope of entering into contract farming by FPC for member farmers 	<ul style="list-style-type: none"> • High risk crop. Slight rain or humidity can damage harvest • Other countries may take up production of the crop

4.1.4. Goat

Strength:	Weakness:
<ul style="list-style-type: none"> • 20 goat specific MTGs and around 4542 families own 17753 goats, averaging around 4 goats per goat rearing family. • Goat milk is healthy and the cluster has a potential for collecting around 15000 L of goat milk per day. • The weather supports goat rearing • It is a secondary source of livelihood for the farmers • There is sufficient availability of fodder and water in the cluster for goat rearing • Nagaur/Ladnun is a breeding ground for Sirohi Goats. • Ladnun is near to Jaipur and also not far from Delhi making it accessible to major goat markets 	<ul style="list-style-type: none"> • Low milk yield and weight gain of non-descript goat population • Low penetration of animal health services and poor infrastructure of existing animal husbandry institutions • Lack of knowledge of scientific goat husbandry practices specially feeding, breeding and management among farmers • Low resources specially among small holders for housing and feeding • Lack of aggregation practices for bulk procurement and marketing • No update knowledge of improves goat husbandry practices among veterinary professionals • Poor marketing practices • Poor Livestock resources (low milk and meat yield) and very poor mechanization resources leads to poor return to the farmers of the project area.
Opportunities:	Challenges:
<ul style="list-style-type: none"> • Goat specific FPC, and goat milk collection center and support system from the RACP project provide enough opportunity for the goat rearers in the area for enhancing livelihood opportunity through creating new value chain for milk and efficient value chain linkages for live goat marketing • Goat cheese can be a good option and marketed with premium price. Fetches around Rs 1000 to 2000/kg depending upon quality. Mostly sold in five star hotels. 	<ul style="list-style-type: none"> • Mortality remains a challenge for the farmers and hence they sometimes tend to sell small animals at half body weight (meat estimation basis). • Traditional Live animal selling practices of without weighing the animal

So is the scope of popularising goat farming with suitable interventions for improving meat productivity. Project intervention will also support small holder's to collectively market breeding animals to institutional buyers.

4.2. Constraints in value chain crops of Ladnun Cluster

The constraints observed under various value chain crops in the cluster are divided under from different categories, viz Production related constraints, Post-Harvest related constraints and Processing and market infrastructure related constraints.

4.2.1. Production related constraints

Bajra

In Kharif Season Bajra has largest area under cultivation in the Ladnun cluster. Productivity & production level in the cluster is low for following reasons

- a. Improper seed bed preparation leading to low germination
- b. Non-adoption of recommended plant spacing as per soil types.
- c. No application of organic manures.
- d. No application of basal fertilizers
- e. No seed inoculation with bio fertilizers
- f. Delay in sowing due to arrival of rains
- g. No protective irrigation

Green Gram

In Rabbi Green Gram has large area under cultivation in the Ladnun cluster. It is a protein-rich supplement to cereal-based diets. Productivity & production level in the cluster is low for following reasons

- a. Use of new high yielding certified, truthful varieties of Green Gram, is low in the cluster.
- b. Poor water management practices
- c. Non-availability of quality seeds in time of sowing.
- d. Improper protection from pest and diseases followed

Isabgol

Isabgol is important crop in Ladnun cluster in rabbi season. Isabgol has the decent amount of soluble and insoluble fiber, which helps to make it a **good cure for constipation**. Productivity & production level in the cluster is low for following reasons

- a. Unwanted rainfall before harvest time damages the crop
- b. Non adoption of good quality seed.
- c. Non adoption of proper cultivation techniques.
- d. Non-availability of irrigation water

Increasing adoption level of producer: Farmers are trained with production lead extension approach till date but hence forth market led extension approach is necessary to increase farmers' income in terms of money. For increasing level of adoption of good agriculture practices to reduce the constrains in value chain of crops following strategies are proposed in agriculture extension-

- a. Multi- agency Extension Strategies
- b. Farming System Approach
- c. Convergence of ongoing schemes
- d. Sustainability of Extension Services
- e. Improving productivity and income of existing crops.
- f. Promoting diversification and or intensification of crops and enterprises
- g. Improving sustainability in production and income
- h. Mobilization of farmers Groups
- i. Increasing Research- Extension – Farmers linkages by organizing farmers –scientists interaction, Field Days and Kisan Goshties farmer field schools.
- j. Farmers oriented activities for their capacity building regarding production, post-harvest management, value addition, processing and marketing
- k. Farm Information Dissemination through District level exhibition, Kisan melas, fruit, vegetable shows, information dissemination through Printed materials, technology package, electronic media
- l. Mainstreaming Gender Concern

4.2.2. Post-Harvest related constraints

Green gram

There is lack of post-harvest facility except sun drying in Green gram produced. There is practice among the farmers directly taking harvested Green gram from farm to mandi without drying or cleaning.

Bajra

In bajra manually harvesting and threshing is laborious. Difficult to harvest as Bajra is usually cultivated with mix cropping .

Isabgol

There is lack of cleaning and grading facility in Isabgol. Lack of proper storage facility as rainfall can damage the crop.

Inadequate storage facilities in rural areas: Storage facilities in villages are found to be inadequate which contributes leads to distress sale. Due to lack of storage facilities, substantial quantity of commodity is also lost. Distress sale is obligatory on some farmers as they have to repay the loan availed from traders during the time of sowing for seed, fertilisers etc.

Transportation facilities at producers' level: Due to inadequate facilities of transportation at the village level, producers are forced to sell in the village itself to itinerant merchants or traders directly at low prices. Aggregation and negotiation with buyers is only possible if farmers have volume to trade and transport up to procurement centre.

4.2.3. Processing and market infrastructure related constraints

Green gram

The processing facility is not available at local level. In commercial production of Green gram processors do aggregate produce at cluster level and transport to their respective processing facility.

Bajra

Processor aggregate Bajra at cluster level and after primary processing and packaging, send Bajra to whole sellers and retailers while remaining material goes to animal feed unit.

Isabgol

Nagaur APMC mandi is one of the biggest mandi of Isabgol. Farmers from other district come to Nagaur to sell their crops. Transportation cost is high. Traders sell crop to processors based in Gujarat state. Bikaner APMC mandi traders have started aggregating Isabgol now a days.

Traditional system of marketing: In the cluster, there is an absence of alternate channels of marketing. So farmers typically sell only through APMCs or village level traders.

Lack of market intelligence services: Farmers do not receive information on market prices. Some farmers sell crops through village level traders, because due to which they are not realising fair price.

Lack of primary processing infrastructure:

- i. There is a non-availability of facilities for primary processing: cleaning, grading & sorting at the farm level.
- ii. There is no practice and provision of producer level storage.
- iii. There is acute lack of awareness among farmers regarding FAQ (Fair Average Quality) standards.
- iv. Farmers do not practice the usage of basic equipment like moisture meter and weighing machine.

Distant markets: The nearest market from the cluster is the Didwana, Nagaur APMC that is approximately 60 kms & 80 kms away respectively. This leads to farm gate selling where farmers receive non-competitive prices for their produce.

Fluctuations in prices: Generally, the price of commodities goes down in the post-harvest period due to heavy arrivals in the markets and later shoots up. Farmers in the catchment area do not have storage facility to store and they also don't use a warehouse receipt system.

Lack of marketing information: Due to a lack of market information regarding prevailing prices, arrivals etc., most of the producers' market in the Mandis without studying the price trends.

Adoption of grading: Grading of Bajra and green gram at the producers' level ensures better prices to producers and better quality to consumers. At present there is no infrastructure available at the farmers' level for primary processing.

Malpractices in markets: Many malpractices prevail in the markets i.e. excess weighment, delay in payment, high commission charges, delay in weighing and auction, different kinds of arbitrary deductions for religious and charitable purposes etc. oil percentage in mustard is determined by rubbing on wall by the traders.

Hundekari System : Farmers are compelled to sell the produce to the trader from whom he has received credit for sowing of crops. It was observed that even MSP procurement is facilitated by the respective trader of that farmer for weighing and bagging of his produce to FCI through Indian ware Housing Corporation.

Infrastructure facilities: Due to inadequate infrastructural facilities available with the producers, traders, millers and at market level, the marketing efficiency is affected adversely

Long Supply Chain: The existence of a long chain of middlemen also reduces the producer's share in consumer's rupee.

4.2.4. Agri business policy related constraints

Contract farming: Rajasthan has adopted a model APMC Act, 2007. In Rajasthan Contract farming of desired variety and quantity as per buyer's/processor's need, has been allowed. Buyer/processors may supply inputs and technical know-how and farmers may produce the crop for sale to buyers at an agreed price. However, this price shall not be lower than minimum support price and title of land shall remain with farmer. Produce will be purchased at buyer/processor's business/factory place. But processors found less interested in registering under contract farming. As per the discussion carried out by Team ABPF with some of the processors regarding contract farming, the common issues and challenges are given below:

- i. **Rule 5** – Each agreement shall be written on stamp paper of the value of Rs.100. This increases cost of procurement and procurement time.
- ii. **Rule 9** – Separate registration form shall be filled for each agreement. Large amount of paper work can be reduced by group registrations or procurement directly from FPCs.
- iii. **Rule 17**-In case the contract farming buyer fails or refuses to purchase the agreed quantity of the agriculture produce from the contract farming producer, he is to pay the amount of the difference between the agreed price and the actual sale price of the contracted produce in the market committee concerned to the producer. Mutual termination of contract should be allowed.
- iv. **Rule 19** – The contract farming buyer need furnish an undertaking equal to 20% of the value of the contracted amount. This amount can be reduced and this will motivate big players to participate in contract farming.

4.3. Intervention plan of selected Value chain crop of Ladnun Cluster

The intervention plan in the selected commodities in the light of critical constraints may be viewed as follows:

Bajra:

S. No	Constraints	Action
1.	Production	
1.1	High production cost due to cost of seed and Agri input requires like fertilizer pesticides etc.	Pooled procurement through FPCs to reduce cost of inputs and ensure quality inputs.
2.	Post-Harvest	
2.1	Moisture content of harvested Bajra is high, because of that farmers get less price.	To make Framers aware about market price of bajra proportionate to moisture content, making availability of moisture meters in FCSC
2.2	High dirt content /foreign material in harvested millet.	Ensure availability of the Cleaning & Grading facility to farmers; usually in 10% higher income accrual to farmers.
2.3	Lack of market information related to price	Price discovery through NCDEX, eNAM
2.4	5 / 11 quintals/acre in poor/good harvest. During good harvest prices Collapse and hence storage option could help and distress sale.	Storage facility for farmers as part of FCSC
3.	Processing	
3.1	Not aware of special license option to source directly from farmers /FPOs.	Awareness seminars for farmers/Processors
3.2	Limited processing products are available in bajra	Promote handmade Namkeen bajra product
3.3	Lack of proper Product marketing	Awareness on Product Branding
3.4	Processor not aware of schemes of the GoI Including CLCSS, cluster Development scheme or “Sampada” for technology upgrading.	Awareness seminars for processors

- **Green gram:**

Sr.no	Constraints	Action
1.	Production	
	Limited Production of processing friendly varieties- Nagauri (model) 77% yield. Others varieties less than 50%	seed production program using Raj seed /seed assistive (twin with cluster)
2.	Post-Harvest	
2.1	Moisture content of harvested pulse is high	Drying facility required at farm level by way of CFC.
2.2	High dirt content in harvested pulse.	Ensure availability of the Cleaning & Grading facility to farmers.
2.3	Mostly rain-fed crop usually resulting in harvesting of immature grain without water/critical irrigation at time of pod filling. Resulting in small-sized grain hence yield in milling is low.	Farmer training, watershed management /sprinkler irrigation, pond + drip option etc led to be considered.
2.4	4/8 quintals/acre in poor/good harvest. During good harvest, prices tend to collapse and hence storage option could help reduce distress sale.	Storage facilities for farmers as part of FCSC
3.	Processing	

3.1	Lack of awareness about special license option to source directly from farmers /FPOs.	Awareness seminars for farmers and processors
3.2	Export of imported pulses only after value addition. "Food Security Agreement" Import from Africa, Myanmar, Canada and Australia subject to import duty of 12-25%. Restricted stocking limits of processors deterring more procurement during bumper crop season.	Advocate for reducing import duty at least during off season in Rajasthan. Alternatively, higher duty/ less or cap on quantity during surplus periods. Advocate higher stocking limits at least during bumper crop periods and lifting ban from exports
3.3	Banks do not support adequate storage of pulses.	Banks to accommodate longer duration storage of pulses to at least 4-5 months to enhance viability of processing units.
3.4	Dal millers not aware of schemes of the Govt Including CLCSS, cluster Development scheme or "Sampada" for technology upgrading.	Awareness seminars for processors

- **Isabgol**

S.no	Constraints	Action
1	Production	
1.1	Many a time's seed prices rise very high due to speculation during sowing time.	Seed production program using sources of Raj seeds through FPC
1.2	Many farmers use local seeds for more than 3-4 years causing problems in germination and yield.	FPC to take up seed and other agri input distribution for member farmers
1.3	Slightest rain during harvesting could damage the entire crop	Weather forecasting services for farmers
2	Post harvest	
2.1	Dearth of adequate storage facility for seed protecting from moisture	Storage facility for farmers as part of FCSC through FPC
2.2	Large no. of intermediaries in the value chain leads to low producers income	Middlemen to be replaced by FPC. FPC would directly procure from farmers and sell to processors
3	Processing	
3.1	Lack of cleaning and packaging facilities which result in losses	Provision of cleaning and packaging facilities as part of FCSC through FPC
3.2	Limited number of processing units such as guar gum processing unit in the region	Facilitate start up in secondary processing from among FPC members or individual entrepreneurs; ties with large players such as Hindustan gum

- **Goat**

S.no	Constraints	Action
1	Production	
1.1	Most of the available animals are non-descriptive resulting in low yield of milk/meat	Distribution of bucks of good variety
1.2	Farmers do not take proper care of the goats	Training on improved goatry practices including housing, feeding, grazing etc.
1.3	Mortality of goats	Rural Technology Center for providing health care services and promoting rural employment
2	Marketing	

2.1	Non availability of milk supply chain	Piloting goat milk collection, value addition and market linkage through FPC
2.2	Non availability of live goat marketing infrastructure	Promotion of goat marketing through FPC through rural haat.
2.3	Non availability of community institution for goat rearers	Promoting a goat specific FPC

4.4. Interventions in the value chain crops of Ladnun cluster

4.4.1. FPC Development Approach

The FPC development approach may be viewed as depicted below:



Figure 6 FPC Development Approach

Following are the steps to be followed for formation of the FPC:

- i. **PRI of the MTG:** The MTGs will be made aware on the FPC model through PRI and individual farmers will be motivated to join the FPC as shareholder through respective MTGs.
- ii. **Initial discussions with MTG leaders:** After PRI is done, initial discussion will be done with the MTG leaders for further orientation on FPC concept.
- iii. **Identification of MTG leaders:** MTG leaders who show inclination to the concept will be selected in the executive committee for FPC formation.
- iv. **Resource mobilization and FPC planning:** The executive committee will meet 2-3 times to plan further activities of FPC viz. crops, strategy for business etc.

- v. Election of BoD and Share collection: 10-12 BoD will be identified along with 2-3 expert directors one each from Agri, Horti, AH and WS dept. The BoD will decide on share value and initiate collection of share through MTG leaders.
- vi. **FPC registration:** Following identification of FPC BoD, registration will be done. This may take 1-2 months as DIN no of BoD has to be generated first. Care should be take that all elected BoD should have PAN no so that there is no delay in paper formalities for registrations.
- vii. **FPC business:** Following registration of FPC, ABPF will prepare business plan for the FPC and facilitate market linkage for input and output.
- viii. Setup of processing/ financing – ABPF will further facilitate establishment of processing unit setup along with feasibility studies and planning business linkage with market players.

4.4.2. Policy and Management

A PC will function within the overall policy and regulatory framework as per the Producer Company Act. The management of a PC or FPO will vest with the elected Board from amongst the members. The provision about constitution of managing committee will be made in the byelaws. The management of PCs will be by an elected Board of Directors. Therefore, the representatives of farmers will actually oversee and manage the affairs of a Producer Company or FPO.

The selection criteria for membership of FPC may be viewed as follows:

1. A member will express his willingness to become a member of PG / CIG / FIG.
2. A member will actively participate in all functions and activities of PG / CIG/ FIG and PC.
3. A member will contribute his equity to the Producer Company (PC)
4. A member will bring all or part of his produce to the PC for sale.
5. A member will purchase all or part of his farm inputs through the PC.
6. A member will produce and prepare his produce for marketing as per directions of PC.
7. A member will contribute his share to the Producer Association as upfront payment for the business development plan of a PC as needed.
8. A member will contribute his share to the Producer Company towards the reserves of PC as needed.

Illustrative list of components of a common facility of a Producer Company (Food Grain)

- i. Godown for storage, drying platforms
- ii. 2-3 MT per hour grain cleaning, grading, and packing machinery with shed
- iii. Additional need based Agricultural Equipment
- iv. Computer with internet connectivity for market information
- v. Display Board with Accessories
- vi. Auction Hall
- vii. Input Suppliers Shops
- viii. Toilets
- ix. Drinking water & Electricity

Note: Though the illustrative infrastructure proposed is shown in the above tables, the actual infrastructure to be developed will be need based and on participative consultation process.

Typically, start-up may be involved in secondary and tertiary processing activities while FPO's may be involved in post-harvest and primary processing activity. In many cases, start-up may emerge firm within FPO members.

4.4.3. Introduction to FPC Model

Aggregation is the proposed solution of the constraints farmers are facing at present. It is proposed to form Farmers Producers' Company by bringing farmers together in the form of voluntary groups of about 15 to 20 active farmers and federating 20 to 25 such groups into a Producer Company.

These Producer Companies will be functioning on behalf of member farmers and will strive to undertake a range of activities which will result in added value accruals to farmers and value to farmers produce. To form a producer company, producer groups will be mobilized (in some cases, this initiative may have already been completed by NGO's).

It is envisaged that an elected committee of members of Producers Groups will form a management committee and oversee the performance of an incentivized manager/CEO. The manager will be trained in technical issues of post-harvest management, marketing and in operating a transparent accounting system. The ABPF will support the operation of the Producer Company, and accelerate the cross learning of best practices.

The evaluation of success should be evaluated on the parameters as under:

- i. PCs operating without financial support by the end of 36 months.
- ii. The PC operates with a reserve fund to cover short term cash flow deficit and with potential for reinvestment in various activities
- iii. The PC has an effective governing structure.
- iv. The PC has a transparent accounting system.
- v. The PC can function as a working example for other farmer organizations to observe and learn from.
- vi. Contribution towards increasing farmers'/members incomes.

Chapter – 5: Value Chain Investments

5.1. Rationale for these investments

Post-Harvest infrastructure is of great relevance to smallholders, who tend to be geographically dispersed. The lack of primary processing infrastructure and efficient transport can therefore be a particular obstacle, making it difficult for them to obtain essential inputs and get their produce to markets. When smallholders do have access to transport services, the cost is often very high, limiting their competitiveness and ability to participate in agricultural value chains. Small-scale producers are at the greatest risk of significant post-harvest losses owing to the use of rudimentary storage facilities and limited access to reliable and efficient transportation systems. In the absence of primary processing infrastructure, transportation, farmers carry most of the produce (without any processing) themselves, often resulting in limited loads and produce spoilage. Small-scale farmers may also lack the resources to comply with increasingly strict food safety standards, particularly traceability requirements. It is therefore important to integrate and empower small-scale agricultural producers in the food supply chain by giving them access to information and communication technologies. Access to the right information at the right time gives smallholders the capacity to make informed decisions that enable them to optimize their price negotiations and the way in which they place their produce on the market.

As goat or small ruminants are basic livelihood of the villagers / farmers, so the emphasis on these aspects is to be needed in the cluster. Therefore, appropriate investment provision has to be made in the cluster. The support to small ruminants will focus on improving productivity through breeding, feeding and health activities at the cluster level. Improved feeding will not only aim to optimize the use of crop residues, but also make better use of common property lands.

5.2. Non water use interventions in value chain

The focus of this sub-component is on improving on-farm water use efficiency and productivity in the clusters by promoting micro irrigation techniques, demonstrations and crop husbandry practices which improve agricultural productivity, profitability and sustainability while reducing the water footprint of agriculture.

5.2.1. Agriculture

Pearl millet (Bajra), Cluster bean (Guar), Green Gram (Moong), Moth bean, Wheat and Mustard are the major crops of the cluster. Use of sprinklers is picking up to reduce the production cost and improve the irrigation/ field water use efficiency. However, introduction of more efficient techniques (viz. Drip and mini sprinklers) is imperative along with the increment in domain of sprinklers. Fertigation and Automation techniques need to be demonstrated to synergise the micro irrigation technology.

The hybrid varieties for Pearl Millet crop and improved seed of the Mustard crop is being used but the seed replacement rate (SRR) for Guar, Green Gram and Wheat needs to be further enhanced by more promising varieties. Seed production activity and adoption support for the same is required. More promising crops, varieties and technology also needs to be intervened to match the fodder demand of the cluster area. The Integrated Nutrient Management (INM), Integrated Pest

Management (IPM) and other innovative techniques are still needs to be intervened for the environmental and techno friendly agriculture.

The soil preparation, sowing and threshing of the crops is performed through tractor drawn implements but still there is a great need to introduce the more efficient mechanization tools for farm operations. Post-harvest techniques are also imperative to introduce in the cluster for the prevailing and ensuing crops.

The farmers' community is supported by the extension machinery of Agriculture department up to the grass root level but the extension system still needs to be compatible with the ICT (Information and Communication Technology) for more effective delivery of the services. Market information and market access is an important intervention to be looked into. The capacity building and regular technical back up to the farmers for the latest updates of the agriculture technologies would be a useful tool for the competitiveness, sustainability and profitability.

Thus looking to the present scenario, the main proposed activities of the Agriculture subcomponent with certain desired objectives are:

- a. Promotion of efficient techniques of irrigation to increase the irrigation efficiency, improve productivity and reduce cost of production.
- b. Diversify the present wheat crop to mustard with the aim to improve the irrigation water use efficiency and to develop a new value chain crop through demonstrations and capacity building.
- c. Promotion of farm mechanization to reduce the cost of production.
- d. Promotion of seed production and adaption support to improve the SRR and the farmer income.
- e. Promotion of fodder production to reduce the gap of demand and availability of fodder for the animals.
- f. Introduction of ICT based extension system for the quick reach of the solutions to the beneficiaries.
- g. Capacity building of the beneficiaries to achieve the PDO.

The Investments and Cost Estimates under Agriculture Subcomponent under RACP Ladnun

To achieve the above proposed cropping pattern and productivity level, the Seed Replacement Rate has to be increased so that productivity can be increased. For achieving PDO the farmers have to be promoted to increase productivity, reduce water in agriculture and to increase field efficiency following investments of amounting of **Rs.1122.89 lakh** and out of this **Rs.866.30 Lacs** as project assistance and **Rs.256.59 lacs** as farmer share have to be done under Agriculture sub component:

Detailed description on the activities is given in the Annexure 5.1.

The Investments and Cost Estimates under the Agriculture Subcomponent under RACP:
Table 13: Investments and Cost Estimates under the Agriculture Subcomponent under RACP

S. N.	Name of sub-component	Unit	Unit cost	Assistance (%)	Phy	Assistance	Beneficiary Contribution	Total Project Cost
						Fin	Fin	Fin
1	Component 1: Climate Resilient Agriculture							
1A	Sub Component 1A: Improved water use efficiency (Micro Irrigation (MI) based technology)							
1	Integrated demonstration for Drip Irrigation System with Automation and fertigation based techniques for field crops	ha	2.20	75	5	8.25	2.75	11.00
2	Integrated demonstration for Mini Sprinkler based techniques for field crops	ha	1.45	75	10	10.88	3.63	14.50
3	Drip Irrigation System	ha	1.10	75	25	24.375	8.12	32.50
4	Mini/ Micro Sprinkler Irrigation System	ha	1.00	75	140	94.50	31.50	126.00
5	Sprinkler Irrigation System	ha	0.20	75	1333	200.00	66.67	266.67
6	Pipeline for piped conveyance of irrigation water	100 mtr	0.10	75	1067	80.00	26.67	106.67
Subtotal 1A						418.00	139.33	557.33
1B	Sub Component 1B: Technology transfer and market led advisory services (Promoting Adoption and Documentation of Improved Technologies)							0.00
1	Soil Testing	Nos	0.00	100	1900	1.20		1.20
2	Demonstrations on production technologies for value chain crops to bridge gap	ha	0.10	75	2320	136.96	45.65	182.61
3	Demonstrations on farm mechanization and PHM technologies	Nos	1.00	75	113	82.50	27.50	110.00
4	Demonstrations on forage/ fodder	ha	0.10	75	172	12.31	4.10	16.41
5a	1. Promotion to seed production	ha	0.05	100	200	10.00		10.00
5b	2. Promotion to Adaption support	ha	0.05	50	1400	35.00	35.00	70.00
6	Innovative activities/ INM/ IPM	No.	1.00	75	20	15.00	5.00	20.00
Subtotal 1 Ba						292.97	117.25	410.22
1B-b	Information and Communication Technologies (ICT) based demand driven participatory extension system (Modernization of extension/ research linkages)							
1	KSK strengthening as model in project area-to serve as level I platform for ICT	Nos	2.50	100	2	7.00		7.00
2	Agriculture Research Institute strengthening to serve as level II/ III platform for ICT	Nos	1.00	100	1	3.00		3.00
3	Honorarium to the experts for solution of the problems and facilitate field visits	LS	1.00	100	2	2.00		2.00
4	Digital instruments to field coordinator/ staff	Nos	0.50	100	20	10.00		10.00
5	Potential threats led/ Pro-P based literature on cluster specific crops	Nos	0.50	100	2	1.00		1.00
Subtotal 1 Bb						23.00	0.00	23.00
Subtotal 1 Ba +1 Bb						315.97	117.25	422.22
Subtotal 1 (1A + 1 B)						733.97	256.59	990.56
3	Component 3: Farmer Organization and Capacity Building							
1	Field days, exposure visits, orientation, capacity building	LS		100	17	23.33		23.33

S. N.	Name of sub-component	Unit	Unit cost	Assistance (%)	Phy	Assistance	Beneficiary Contribution	Total Project Cost
						Fin	Fin	Fin
2	Hiring the Services of NGO for Community Participation, Social Screening and Social Mobilization required for implementation of Cluster Agricultural Competitiveness Plan (CACP)	As per deliverables		100	0	97.87		97.87
	Sub Total 3					121.20	0.00	121.20
4	Component 4: Project Management, Monitoring and Learning							
1	PIA Operating costs including Photostat, computer typing & printing, fax, Machine with man, mobility (hired taxi/POL), TA/DA etc.	LS	3.00	100	2	9.00		9.00
	Subtotal 4					9.00	0.00	9.00
	Total Cost (Agriculture Department)					864.18	256.59	1120.77

5.2.2. Horticulture

In agriculture water productivity is major concern in the state, means promotion of high payoff and low water requiring crops is main focus under the project. The horticultural crops are recognized high payoff, nutritious value crops. Water management issue is also very important issue in the agriculture. Areas depend on rains and ground water is become very important in the field of water management. Whatever ground water is available in the cluster should be used judiciously. The horticulture is one of the sectors has emerged as major drivers of growth in the agricultural and allied sector.

The problems in development of Horticulture are pressures emanating from climate change; post-harvest losses; bio-security concerns; absence of market linkages and resultant price fluctuations; changing quality consciousness; and global competition. These concerns need to be addressed in order to sustain the growth momentum in horticulture. The focus of growth strategy, therefore, needs to be on raising productivity by supporting high density plantations, protected cultivation, and efficient irrigation methods i.e. micro irrigation, quality planting material, rejuvenation of senile orchards and a thrust on post-harvest management to ensure that the farmers do not lose their produce in the transit from the farm gate to the consumer's plate.

Although there is not much horticultural fruit plantations at present, but the availability of Loam fertile land and moderate water provides immense opportunity for the cultivation of fruits as well as vegetables. The area is suitable for fruits like Lemon, Pomegranate, Ber etc., hence, the area under pearl millet in Kharif crops, would be diversified in to the cultivation of vegetables and fruits crops. Looking to the potentiality and acceptance of the area Chilly, Tomato, Pea, Okra and Onion in vegetable crops, Pomegranate, Ber & Lemon in fruit crops are to be promoted through demonstration with drip irrigation.. Solar technology would also be promoted to assure irrigation. Farm mechanization would also be promoted to reduce the cost of cultivation. Post-harvest management would also be promoted.

Based on the above facts and to promote horticulture in the area following activities would be attempted in the cluster:

Promoting Adoption and Documentation of Improved Technologies

Demonstrations on production technologies for Fruit Cultivation:

Under this component assistance to farmers shall be provided for establishment of fruit orchards at normal / wide spacing as well as high density plantations. The attempt has been made to integrate various components of scientific fruit production viz. efficient water use devices like Drip irrigation system with Package of practices, IPM, INM, Fertigation, mulching, automation etc.

Wide spacing crops with inter cropping

Under this activity assistance to farmers for scientific establishment of fruit orchards will be provided. It has been contemplated that various aspects of modern fruit production at wide spacing/normal spacing with intercrop are integrated. The farmers shall be provided planting material, drip system, mulch, fertilizers and plant protection chemicals.

An investment of Rs.112.40 lakh is to be made on demonstration and establishment of 40 ha orchard with Pomegranate, lemon and papaya orchard establishment. The assistance will be provided to farmers 75% of total unit cost Rs.2.81 lakh in different inputs. After plantation of fruit crops in first year, additional support during second year and third year would be given.

Demonstrations on production technologies for vegetable Cultivation:

The cultivation of vegetables has been very remunerative but due to lack of investment capacity of the farmers and involvement of high level of technical skills, the rate of adoption of vegetable as well as floriculture is not picking up the desired scales. It has been contemplated that various aspects of modern vegetable production technologies with drip and automation, hybrid and improved quality seeds, soil sterilization full POP, water soluble fertilizer, mulching, PP chemical and growth regulators and others cultural practices are integrated.

Under this component technological and input assistance shall be provided to the farmers for vegetable technology demonstration. An investment of Rs. 87.60 lacs is to be incurred on demonstration and cultivation of 30 ha with Chilly, Tomato, Pea, Onion & Okra, which are the leading crops & selected for demonstration. The assistance will be provide to farmers 75% of total unit cost Rs. 2.92 lacs in different inputs.

On farm Demonstration on Protected Horticulture

The protected cultivation has opened avenues for intensifying the land use. This can provide excellent avenue for small size of holdings owned by families having ample of underemployed manpower. The weather proof (protected) cultivation results in high quality product and better income to farmers with optimum use of water. There are the two types of protected structure proposed in cluster.

A. Green house (GH) -The benefits of Green House to improve the productivity and quality are as

1. Equal distribution of light inside the green house.
2. To optimize the heat inside the green house.
3. To control the micro climate & establish optimal environment for cultivation & adjust temperature, humidity, lighting etc.
4. Protection against disease, pest etc.
5. Excellent ventilation.
6. Optimum sealing against rains & air.
7. To increase production
8. To ensure off season production, resulting good market rates.

Under this component technological and input assistance shall be provided to the farmers for establishment of G.H. is 75% of total cost of Rs.0.0108 per sqm. The total investment of Rs. 88.00 lacs is to be needed for establishment of green house in 8,000 sqm..

Assistance on shade net house:

Shade net houses provide a cost effective avenue for protected cultivation in areas where the crop production is limited by intense heat and sunlight. The shade net house is a low cost structure which covered by the net for protect the plants from high temperature & heat.

Under this component technological and input assistance shall be provided to the farmers for establishment of shade net house is 75% of total cost of 0.009 per sqm .The total investment for shade net house is Rs.36.00 lacs for 4,000 sqm.

Solar Pump Program:

Energy as input in horticulture has great importance as with increase in intensity of production we need may more and more energy. The solar pumps have paved new pathways for independent energy system for the farmers. It is proposed that solar pump of an estimated cost of Rs.5.5 lac shall be provided to the farmers on 70% assistance. The SPV system should be operated with a PV array capacity in the range of 3,000 watts peak to 5,000 watts peak. The operation of solar powered pumps is more economical mainly due to the lower operation and maintenance costs and has less environmental impact than pumps powered by an internal combustion engine (ICE). Solar pumps are useful where grid electricity is unavailable.

Under this component technological and equipment assistance shall be provided to the farmers for establishment of SPV is 70% of total cost. The total investment for SPV establishment is Rs. 165.00 lacs for 30 SPV.

Horticulture Mechanization

Mechanization is the effective tool to reduce the production cost, increase the efficiency of farm and reduction in chemical weedicides. Power operated machines and mini tractors for field operations, planting, sowing, spraying, Mulch laying machine, training and pruning, grading, harvesting etc. operations are proposed to be provided with the assistance level of 50 per cent to the selected

beneficiary of the cluster. An estimated maximum cost of Rs.7.5 Lac has been kept for the implements/ mechanization technology per unit.

The total investment for this activity is Rs.30.00lacs. The maximum assistance will be provided 50% of the unit cost of Rs.7.5 lacs or 50% of the total cost of machinery and equipment.

Micro irrigation in horticulture crops:

With a view to produce more crop per drop of water and also to obtain higher and qualitative yield from horticulture crops, assistance would be provided to the farmers who are willing to adopt drip irrigation system especially in fruit orchards and vegetable cultivation. Under this component, farmers will be promoted to adopt drip irrigation system. A unit cost of Rs. 0.80 lacs for establishment of drip irrigation in fruit orchards and Rs. 1.30 lacs for vegetable cultivation has been decided. Farmers would be provided 75% assistance for adoption of drip irrigation system. The total investment for this activity is Rs. 21.00 lacs.

Farmers training, Seminars, Exhibition Kisan mela etc.

The training is very significant activity towards achieving project development objective under RACP. The project success is totally depending on successful implementation of trainings under the project. The objective of this activity is to build capacity of farming community as well as project staff so that the objective of agriculture and horticulture sub component may be achieved and awareness of advanced technology under RACP. Time bound and regular trainings programmes would have to be required under the project.

The main objective of the Exposure visits is to realize the farming community, PRIs, community groups, project staff etc. about the impact of the activities proposed in the project. The Exposure visits for farming community, PRIs, community groups, project staff etc. within the state and outside the state should be organized in the project so that they could explore their knowledge as well as experiences about the technical innovations. Exposure visits of successful work/project in State as well as National level should be organized in such a way that more than 20% of members of existing as well as proposed community based groups, members of PRIs, members of concerning project staff are covered in three phases. A data base should also be prepared for monitoring of impact of this programme. These extension methodologies have been proposed to make farmers acquainted with the best available technologies and to promote adoption. The trainings would be implemented as per the training manual of RACP.

The trainings would be conducted in house, through various training institutions including national and state level like Irrigation Management and Training Institute (IMTI), Kota and other Institutes. An amount of 36 lacs is proposed to be incurred on various types of trainings.

The justification with regard to procurement of input, seed and planting material has been given in Annexure -5.2.

The investments under the horticulture sub component

Total **Rs.592.80 lakh** is proposed to be invested on inventions mentioned above of horticulture sub component to make farmers competitive for getting optimum water as well as horticultural productivity in Ladnun cluster. Out of this an amount of **Rs.154.02 lakh** likely to be incurred by beneficiaries and an amount of **Rs.438.78 lakh** would be beard by the project. The investments are being summarized as under:

Table 14 Investments and Cost Estimates under the Horticulture Subcomponent under RACP

#	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Grand Total (Rs. In lakh)		
						Phy.	Financial	
							Farmer share	Project
I.	Component 1: Climate Resilient Agriculture							
IB	Sub Component 1B: Technology transfer and market led advisory							

	services								
1	Promoting Adoption and Documentation of Improved Technologies								
i.	Assistance on production technologies for Fruit Cultivation								
1	Wide spacing crops with inter cropping	ha	2.81	75	2.108	40	28.08	84.32	112.40
i.	First year Maintenance support	ha	0.58	75	0.435	10	1.45	4.35	5.80
ii.	Second year Maintenance support	ha	0.75	75	0.561	0	0	0	0.00
2	High density plantations	ha	5.57	75	4.178	0	0	0	0.00
i.	First year Maintenance support	ha	1.09	75	0.818	0	0	0	0.00
ii.	Second year Maintenance support	ha	1.32	75	0.986	0	0	0	0.00
3	Assistance on production technologies for vegetable Cultivation	ha	2.92	75	2.19	30	21.9	65.7	87.60
4	Assistance on green house	SqM	0.01	75	0.00816	8000	22.72	65.28	88.00
5	Assistance on shade net house	SqM	0.01	75	0.00647	4000	10.12	25.88	36.00
6	Solar Pump Program	Nos	5.5	70	3.85	30	49.5	115.5	165.00
7	Post-Harvest Management	Nos	28	50	14				
8	Horticulture Mechanization	Nos	7.5	50	3.75	4	15	15	30.00
9	Micro Irrigation in Horticulture Crops (Drip System)	Ha							0.00
	Fruits		0.80	75	0.60	10	2	6	8.00
	Vegetable		1.30	75	0.975	10	3.25	9.75	13.00
	Sub Total IB					12134.00	154.02	391.78	545.80
III.	Farmer's Organization and Capacity Building								
1	2 days Farmer's training (50 farmers in each)	Nos	1	100	1	12	0	12	12
2	Exposure visit for 50 farmers for 5 days	Nos.	2	100	2	6	0	12	12
3	Seminar for 100 participants for 2 days	Nos.	2	100	2	6	0	12	12
	Sub Total III					24	0	36	36
IV.	Project Management & M&E								
1	Operating cost including (Photostat, computer, printer, fax, manpower, services outsourcing, mobility (hired taxi), TA for District unit)p	0	LS	100	0	0		11	11
	Sub Total IV					0	0	11	11
	G. Total					12158.00	154.02	438.78	592.80

5.2.3. Livestock

RACP envisages investing and working in a cohesive way with all the identified components for benefitting the farmers especially the small holders in a sustainable manner, up-scaling the successes and documenting the learning. For the purpose it is planned to prepare the Cluster Agriculture Competitiveness plan (CACP). The CACP have a defined objective and after analyzing the primary and secondary data of the cluster proposes interventions including investments, Community level Institutional Development, Water Conservation and Resource Management, Climate Resilient Agriculture, and Value Chain Development. The CACP provides detailed project report for the selected cluster. CACPs are prepared through a participative process involving a broad range of stakeholders, including private sector.

Based on the constraints identified with the community, project investments are planned to achieve the project development objectives (PDOs). The details of Identified and eligible Investments under project are as under.

Climate resilient agriculture –It is planned to improve productivity (milk and weight gain) through investment in breeding, feeding and animal health services.

Market and value Chain improving market access and local level small value addition.

Capacity building- supporting farmer advisory and training of the farmers, and training of existing Animal Husbandry Department's technical staff

Project management & Monitoring

The impact of investment will arrive from increased profit to farmers by getting a higher price for their goats (through access to market information and value chain development not only through sale of animal/milk & meat, but also products like manure, hair, and hides); increased sale of goats due to reduced mortality and higher fecundity; and increased productivity (As a result of better breeding, feeding and healthcare). Women in particular will benefit; they provide the majority of labour for goat production though they are often excluded in marketing.

Water Productivity in Goats

The economic gain to farmers through Goat rearing on the basis of per unit water consumption is estimated. Following assumptions has been taken to attain body weight of 30 Kg in one year; 245 Kg of feed and 249 liters of water consumption and feed cost Rs 10/-per Kg and management cost is 30% of the feed cost with 10% mortality assumed.

Calculation of gains is based on cost of live weight at the rate of Rs 200/-per Kg. For a flock of 100 goats considering 10% mortality net earnings to the farmer is Rs 2533/- per Goat. Economic gain in terms of water consumption is Rs 5.18/- per litre of water.

The following activities would be undertaken at Ladnun cluster under Livestock Strengthening and management component:

Climate Resilient Agriculture

Productivity enhancement

Breed improvement:

Breed improvement and advisory services to ensure breeding cycle coincides with market demand, climatic conditions/ resources availability. This will include:

- i. Improved Bucks distribution to MTG members
- ii. Goat distribution to Widows and/or especially abled women for livelihood development
- iii. Risk Coverage through Animal Insurance

Low milk yield and low weight gain in non-descript goat population of the cluster is the major constraint for improving the farmers income. Department of Animal Husbandry breeding policy recommends Sirohi breed for the cluster area, so it is planned to induct elite breeding bucks in the area. Project will support distribution of breeding bucks to those MTG (Goat) members have at least 10 breeding goats. It is found that in the cluster many women especially widows and disabled are in need of livelihood support and they are willing to adopt goat farming. It is planned to support these women to provide a unit of 4 Goats for adopting goat farming. Asset insurance is critical for the poor and small holder farmers; under the project distributed bucks and goats will be insured with project support.

Table 15 Project distributed bucks and goats

Activity	Total Requirement	Year Wise requirement		
		I year	II year	III Year
Buck Distribution	160	60	50	50
Goat Distribution	40 MTG Members	16	14	10
Animal Insurance	320	124	106	90

The primary objective of investment under livestock strengthening and management component of RACP (Rajasthan Agriculture Competitiveness project) is to improve Goat productivity and provide market access for the produce. This will improve the competitiveness of the small holder and improve her income from the activity.

Goat productivity **majorly depends upon the breed** and also on nutrition & management. In context of the project cluster small goat rearer keeps non -descript (not true to breed) goats; this results in low milk production and weight gain. It is to improve the breed of the goat of the farmers in the project clusters; it is envisaged to induct quality bucks to those MTG members already keeping goats.



Project will primarily support **sourcing of elite bucks from open nucleus farm for multiplier herds (RAJUVAS) and from the multiplier herd to the MTG members**. Goat usually reared by small & medium landholders that too 50-100 in numbers (max) by a farmer; looking to the constraint of resources esp. fodder & space availability. These farmers keep very good quality goats and bucks and by selling the progeny maintain their herd size. These farmers are usually available on the breeding tract of the particular breed. So in a sense well organized suppliers/vendors in the form of large breeders are very limited for buck & goat procurement. There would be many breeding herd from which MTG can select animals directly without involvement of any middleman. It is proposed to **procure buck and goats** by a cluster level committee (including MTG

members & Veterinary doctor of the department of animal husbandry). The committee will procure from organized Farms (very few) and in case of non-availability/ suitability they may procure from private farmers of the breeding tract.

In case of animals' procurement, **selection of each animal is important because standardization of all characters and uniformity among all is not possible**. In the project farmer's contribution for buck purchase is 25 percent of the purchase cost. Bucks & goats being the valuable asset of poor small holder farmer, it is always advisable to cover the risk factor of mortality of the animal or permanent disability through insurance coverage. Considering the importance of Buck/Goat insurance coverage, the component was included in the animal husbandry activities. MTG members will also contribute 25 percent of the insurance premium cost and rest 75 percent will be supported as project contribution.

Improved feeding practices:

This may include through advisory support and better utilisation of local resources; improving fodder availability silvi-pasture development on common lands and fodder demonstration on private lands, better integration of crops with livestock through simple storage, production and processing of crop residues to include, feed blocks, chaffing and fodder banks Watershed department is doing pasture development work in the project clusters. It will be suggested them for plating as per the local climatic conditions and fodder requirement. Potential for storage and pelleting will also be explored. This will include:

Azolla Demonstration to MTG members

The cost norm for demonstrations would cover the expenditure on provision of critical inputs i.e. know-how, seeds, fertilizers, insecticides, micronutrients etc. Fodder Demonstration will be organized/laid out on the field of members of MTGs linking up with Department of Agriculture.

The demand for milk and meat is creating new potential in the profitability of animal husbandry as an occupation. Yet, at the same time, there is a substantial decline in fodder availability. The area under forest and grasslands is decreasing as is the amount of various crop residues available for feed, largely due to the introduction of high yielding dwarf varieties. The shortage of fodder is therefore, compensated with commercial feed, resulting in increased costs in meat and milk production. Moreover, as commercial feed is mixed with urea and other artificial milk boosters, it has a negative effect on the quality of milk and the health of the livestock. The search for alternatives concentrates led us to a wonderful plant azolla, which holds the promise of providing a sustainable feed for livestock.



Azolla is a floating fern and belongs to the family of Azollaceae. Azolla hosts symbiotic blue green algae, *Anabaena azollae*, which is responsible for the fixation and assimilation of atmospheric nitrogen. Azolla, in turn, provides the carbon source and favourable environment for the growth and development of the algae. It is this unique symbiotic relationship that makes azolla, a wonderful plant with high protein content.

Demonstration of Azolla with capacity of producing sufficient Azolla for feeding minimum 20 +1 unit of goats daily (Approximately 3 KG. Daily) will be organised at MTG's field. AS being the new technology, initial 1-2 days field training & hand holding support and all inputs will be provided with project support. One demonstration is proposed to be given to a farmer.

Activity	Total Requirement	Year Wise requirement		
		I year	II year	III Year
Azolla Demonstration	200	0	100	100

Chaff cutter Demonstration to MTG members

To save the wastage and improve digestibility of fodder, the project will demonstrate and motivate chaff cutter use by small holder farmers. Good quality manually operated Chaff cutter as per BIS specification will be provided to goat rearer with project support. DAH through NGO will promote regular use of chaff cutter.



Activity	Total Requirement	Year Wise requirement		
		I year	II year	III Year
Chaff Cutter Distribution	300	100	100	100

Feed supplement to Goat & Buck of the cluster:

Goats have an ability to thrive in the harshest environments. Their high digestive ability enables them to deal with high cellulose/high fibre diets of a very coarse nature; with its relatively large digestive system in relation to its body size, the work of digestion involves the use, and loss, of large quantities of minerals. Goats are also prolific breeders; achieve sexual maturity at the age of 10-12 months. Gestation period is short and at the age of 16-17 months starts giving milk. Twinning is common and triplets and quadruplets are also possible.

It is observed that growth rate (body weight gain) and timely fertility gain of female goat restricts goat farming economics in the cluster. One of the reasons in the cluster is absence of essential minerals and vitamins in the goat feed. Small holder's lack resources to buy quality feed supplement and DAH resources usually exhaust with large dairy animals.

In this context project may support the goat population of the cluster for feed supplement (20 gm per day for 90 days in a year) to demonstrate the benefits:



Activity	Total Requirement (KG)	Year Wise requirement		
		Ist year	II year	III Year
Feed Supplement	18000	0	9000 Buck & Goat	9000 Buck & Goat

Animal Health Services

It is observed that timely availability of animal health services both prophylactic and curative are very important for ensuring productivity and this leads to better returns to the farmers. Common diseases like PPR, ET and kid mortality can easily be controlled by animal health management. For animal health management major identified needs in the cluster are:

- Availability of animal health services at village level
- Regular Deworming and Vaccination
- Local Resource for motivation and support
- Regular health check-up of the stock
- Strengthening of Animal Husbandry institutions for providing quality animal health care

For the above proposed activities/facilities the following investments are planned for livestock owners especially the small holders Animal Health services will be provided to Large as well as small animals through Animal health Camps, RTC and Mobile Van

Establishment of Rural Technology Centers (RTCs)

Suitable existing institutions of Department of Animal Husbandry will function as Rural Technology Centres (RTCs) in the project clusters at the strategic location for livestock development with aim to provide health, prophylactic services and centres for technology demonstration & extension.

There would be two types of RTC: A & B Grade, “A” grade shall ideally be centrally located. Vet. Doctor placed at RTC ‘A’ grade will be responsible for organising all the project activities under DD LSD / OIC RACP supervision, in the cluster and also manage emergency animal health services.

DAH has 4 Veterinary hospitals (Nimbi Jodha, Bharnawa, Sonari, Odeent) and 1 sub centres (Manu) in the project area. But available infrastructure is not sufficient to provide effective services to the livestock owners. Therefor additional support is required for extension and capacity building services at technology centres.

Following Locations in discussion with community and department of AH are identified for RTC’s in the Ladnun cluster

RTC “A” Grade:- Nimi Jodha

RTC”B” Grade:- 1. Odeent

Project will support building construction and procurement of basic furniture, equipment’s and recurring expenditure during project period for effective functioning of RTCs. RTC will have organic relation with DAH as after the project period, assets and functions will be transferred to DAH. The RTC will also have facility for feed & fodder, vaccine, medicines & mineral mixture Storage. Meeting place for MTA/PO/Cluster federation, RTC can be a place for organising health camps, training, exhibition and seminars.

RACPPMU & DAH with the help of construction expert will finalise the design of the RTC. RTC will also have required equipment and furniture etc. Facilities for organising trainings, meetings and farmer’s workshop will also be created. The project will also support operating cost of the RTCs that will include office expenses, running and maintenance cost of the emergency mobile vehicle.

Health and Awareness camps

- It is planned to organize need based health and sterility camps periodically through Rural Technology Centre (RTC)/ DAH institutions in order to cover all health related issues in the project area and provide services at the village level itself. The health camps will be organized for vaccination; deworming, etc. **at least once in a month in each gram Panchayat.** The cluster covers 5 Gram Panchayats, so 5 Animal Health Camps per month will be organised.
- Organization of health care and awareness camps by RTC/ DAH institutions where activities like vaccination, de-worming, castration, Feed supplement distribution, treatment, extension, etc. will be undertaken.
- Health check-up and treatment of infertile animals shall be covered in these camps. Department of Animal Husbandry in consultation with research institutions shall provide technical aid in addressing health related problems in the project area.
- DAH will organise health camps under its free vet. Medicine and **“Pashu Chiktsayalya Pashu Palakke Dwar”** scheme and project will financially support Rs.5000 per camp for additional expenses. This will cover expenses towards registration/vaccination, cleaning, tent, sitting, water, publicity, small refreshment and miscellaneous/contingency.
- Further the opportunity will be used for organising Farmer’s meeting (Pashu Palak Goshti) of at least 50 farmers for disseminating the latest technical and other information and knowledge of animal husbandry.



Activity	Total Requirement (No)	Year Wise requirement		
		I year including 2015-16	II year	III Year
Animal health Camps (One per GP per month)	191	71	60	60

Mobile Emergency Animal Health Van cum Ambulatory clinic:

The mobile emergency animal health van cum ambulatory clinic is an excellent support tool for implementation of the activities related to the animal husbandry. The Mobile van will provide animal health services.

The Project will provide one Mobile animal health van cum ambulatory clinic in the cluster and 100% cost will be borne by the project and it will be procured by the project as per the World Bank procurement guidelines. The project will also support its running and recurring expenditure during the project period. It will be handed over to the DAH and will be used for providing the services in the cluster. The Mobile vehicle shall be equipped with storage of medicine/ vaccines, primary testing and minor surgical interventions. Department of Animal Husbandry Rajasthan has given commitment for operating RTC and Mobile van to provide regular services to the project cluster even after the project period. The assets has been handover to the DAH



Installation of Travis in project cluster:

Project will support the animal health services in the project cluster villages, and for inspecting the animal it is essential to restrain the animal. This is safe for the professional and also comfortable for the animal. It is planned to install Travis for restraining the animals in all the villages where already not available through department of animal husbandry. It is found that **5 villages** of project cluster do not have Travis installed for animal inspection, so 5 Travis will be procured and installed with project support.



Animal husbandry management and advisory support

Distribution of Feeding and water troughs to MTG members

It is observed that there no standardisation in feeding and watering appliances. The animals tend to contaminate the feed in most of these devices by voiding faeces and urine and by standing inside or over these feeders or keeping the fore legs inside these devices. Farmer incurs about seventy per cent running expenditure on feeding material. To minimise the cost it is of utmost importance to reduce the wastage and contamination of feed and to increase efficiency of feeders. It will also help in the prevention of goat diseases, caused due to contamination of feed and water. Design developed by CIRG (central Institute for Research on Goats) Makhdoom U.P. will be utilised as these feeders are suitable for various types of feed and fodder.

Activity	Total Requirement (No)	Year Wise requirement		
		Ist year	II year	III Year
Feeding & Water Trough	200	50	75	75

Heifer International will also be consulted for alternative model. This unit (One feeding trough and one water trough) is costing Rs 5000 i.e. USD 80 only. Average life of the troughs are at least 5 years. In feeding trough fodder and concentrated can be feed in parallel. Through Water trough it will be demonstrated the importance to making available water ad lib for improving milk productivity and growth. Many Breeding Farm and herds are already using CIRG model by themselves.

Goat Housing

Presently Goat rearing on zero input concepts is mainly sustained but this does not provide attractive returns to the farmers. Goat are exposed to harsh environmental conditions, does not

provided balance ration and scientific health management; leads to underutilization of resources and lower returns.

Project will support adoption of intensive or semi intensive goat management system by the farmers. Goat housing is important in intensive system of production; in fact one must ensure proper comfort of animals for production to gain maximum profits. The main aim of housing is to protect animals from harsh, uneven climate as well as environmental stress. The goats shall be provided enough floor space to avoid crowding and proper ventilation. NREGA Model has been adopted so that remaining beneficiaries can be motivated and linked with NREGA for adoption

Project will support construction of goat house for one (20 goats+1Buck) Unit with 220 Sq Feet floor space. The design will be prepared by utilising the local material to reduce cost.

As referred from the NREGA guidelines the goat house for 20 goats cost Rs.66000 per house. The same low cost houses may be supported in the project. Goat farming is primarily adopted by poor and small holders' farmers and their capacities to create asset is always limited. Project may support 75 per cent of goat house cost and remaining 25 per cent cost will born by the beneficiary.

Activity	Total Requirement (No)	Year Wise requirement		
		Ist year	II year	III Year
Goat House	20	0	10	10

Lady Link Worker cum Marketing Facilitator

Small Ruminant development especially for small holder is possible only through regular and timely help. This is only possible when a local resource person is available with information and professional linkage. Under the project it is envisaged that one progressive women farmer preferably MTG member per Gram Panchayat, will be trained as resource person i.e. Lady Link Worker cum marketing facilitator.

This worker will be the local common linkage both for the project and women farmer. She will maintain the inventory of MTG members', their goats, goat health status, project activities schedules etc. She will coordinate organisation of camps and Goat Haats for the project beneficiaries. In Ladnun cluster 5 Lady link workers will be selected as per the guidelines and trained for the responsibilities through ARAVALI. **LLWs will have support of ICT application for information dissemination and marketing access.**

Roles and Responsibilities:

- LLW will facilitate extension services; make farmers aware about vaccination, de-worming and health care, feed - fodder and housing and other management practices.
- LLW would support in timely implementation of various activities planned under AHD component of RACP
- LLW would also facilitate formation and mobilising the MTG (goat)
- LLW shall play a role in creating awareness about animal health, safety in case of outbreak of contagious diseases, extreme climatic changes like heavy Rainfall, flooding, extreme cold and hot temperatures, food scarcity due to drought.
- LLW shall creating awareness in neo-natal care of young kids and does, weaning and milking of goats.
- Lady Link Worker shall play role of entitlement facilitator and enhancing outreach of schemes of Department of Animal Husbandry to marginalized farmers.
- She will maintain an inventory of ready to market animals for organizing rural haats and also motivate farmers to sell animals on weight basis.

These LLWs will be supported initially for monthly work related honorarium. After Project period the model will be self-sustainable. The LLWs will make following services available to the goat farmers and on cost basis:-

1. Sale of Bucks and Goats (On commission Basis)
2. Selling feed and other inputs
3. Selling inputs like Azolla, Chaff cutter, Clean milk Kits, weighing balance, feed and water troughs etc. They will be linked with the quality supplier of the project.
4. LLWs may also be train for goat milk collection and testing so they can work as milk collection center operator (commission Basis)

Market and Value Chains

To improve market and value addition, the project will support:

Formation of Farmer Producer groups.

Multi Task Groups (MTG) for Goats that would enable the producer to access diversified markets, better access to inputs and services on a gender equitable basis and access to market information. The Goat farmers are to be organized into MTGs @10-15 farmers per MTG through NGO selected by PMU RACP. On the basis of the potential of goat farming and available resources a total of **20 MTGs (Goat) will be organized in the project cluster**. Selection criteria for Small Ruminants (SR) farmers to become member of MTG would be as follows. Farmer should be:

- i. Only women and preferably small or marginal goat rearer
- ii. possess at least 3 goats (not essential for widows and specially abled)
- iii. Willing to participate in the programme and willing to contribute her investment as per pattern of funding.
- iv. Members of SC/ST community must be included at least as per the funding pattern.

Distribution of weighing scale to MTG members

Live goat sale is the largest adopted method by the small holder farmers. Some time in case of urgent need it becomes ready cash for the farmer. Goat sale usually occurs through middle man, who are taking the benefits of approximation and cheats the farmer by paying less in comparison to animal's actual weight. Project may provide advisory to MTG members for weighing the animals before selling and will also provide weighing scale for ready use. Weighing scale will also help farmers to know the weight gain of animals for supporting the right quantity of feed intake.



Activity	Total Requirement	Year Wise requirement		
		I year	II year	III Year
Weighing Scale	300	0	300	0

a) Goat Milk Value chain and Clean milk production

Nagaur and Ladnun cluster in particular has substantial goat milk production and strengthening goat milk value chain will provide remunerative price to the small goat rearer. The value chain may include milk collection, chilling and value addition and packaging. Nearness to Ajmer market will provide opportunity to market value added products like Goat Cheese. Value addition demands high quality milk and project proposed to support this practice in a coherent manner for adoption at the large scale. Good quality raw milk must be: a. Free from debris and sediment. b. Free from off-flavours. c. Low in bacterial counts. d. Normal composition and acidity. e. Free of antibiotics and chemical.

Capacity Building and Training

Goat Management training of MTG members

A training need analysis has to be done for various stakeholders like goat farmers, NGO, and AHD staff. Accordingly the relevant training programs will be organized for all the stakeholders. It will be ensured that majority of the members of MTG receives basic training involving skill upgradation and orientation on the technical and organizational aspects. . Farmer Field School (FFS) model will also be adopted in the project.



Project will support to organize exposure visits of successful Animal Husbandry projects for members of MTGs and professional staff with the aim to adopt best practices and improved technologies. Project will also support refresher training of the professional staff engaged in project implementation at national level institute in relation to goat development.

In each village all the members of the MTG will be given Goat management 3 Days training at RTC/GP/Village level. This will cover General Management, Breeding, feeding esp. fodder development and Goat marketing esp. synchronization as per the market demand.

Activity	Total Requirement (No)	Year Wise requirement		
		Ist year	II year	III Year
3 days MTG Goat Management Training & 1 day refresher course	<u>300 MTG Members</u>	60	240	-

Professional Training

It is observed that the knowledge of the veterinary professionals in the project cluster is also limited for goat management practices especially for latest development for feed and breeding, as well as for cattle and buffalo . Veterinarians focus on animal health and have little knowledge of feeding and nutrition, breed improvement, housing and management, and marketing. They also do not receive any training in business management, farmer extension and communications

Professionals training of the DAH and project staff will be organized at reputed national institutes.

Goat Exhibition cum Seminars

Goat Exhibition cum Seminars will be organised to motivate farmers for rearing quality animals and showcasing the best practices. RTC will take the initiative with the help of NGO and under JD/DD LSD supervision. The goat exhibition cum seminars will be organised at the cluster level and as per the approved action plan and Project guidelines

Estimated Cost of Investments on Livestock activities

An estimated cost amounting of **Rs.277.32 302.32 lacs** is to be incurred as tentative investments for the implementation of various activities in Ladnun cluster. Out of this an amount of **Rs.16.44 Lacs** would be beard by beneficiaries and **Rs.260.88 285.88** by project. The tentative Action Plan & Cost Estimates for Ladnun cluster is being summarized as under:

Table 16 Estimated Cost of Investments on Livestock activities

S. NO.	Items	Unit	Unit cost (Rs. In lac)	Assistance (Rs. In lac)	Physical	Total Financial (Rs. In Lacs)		
						Farmer Share	Project Cost	Total Cost
I.	Climate resilient agriculture							
1 C	Livestock Strengthening and Management							
3	Distribution of bucks (farmers)	No.	0.100	0.075	160	4	12	16

S. NO.	Items	Unit	Unit cost (Rs. In lac)	Assistance (Rs. In lac)	Physical	Total Financial (Rs. In Lacs)		
						Farmer Share	Project Cost	Total Cost
4	Distribution of goats (widows & disabled) (one unit of 4 goats)	No.	0.32	0.320	40	0	12.8	12.8
5	Goat insurance(8% per annum) of units receiving improved bucks and does	No.	0.008	0.006	320	0.64	1.92	2.56
6	Veterinary Health Camp support (one camp Per GP Per month)	No.	0.05	0.050	191	0	9.55	9.55
7	Establishment of regional technology center (rtc)							
i.	A- grade	No.	60	60.000	1	0	60	60
ii.	B- grade	No.	30	30.000	1	0	30	30
8	Vehicle for emergency animal health services	No.	10	10.000	1	0	10	10
9	Operating cost of RTC including POL for Vehicle	No.	3.6	3.600	4	0	14.4	14.4
10	Link worker/MF honorarium (One per Gram Panchayat)	No.	0.36	0.360	15	0	5.4	5.4
11	Azolla demonstration	No.	0.065	0.065	200	0	13	13
12	Housing supports	No.	0.66	0.495	20	3.3	9.9	13.2
13	FEEDING & water TROUGHS DISTRIBUTION	No.	0.05	0.038	200	2.5	7.5	10
14	Travis installation in project villages (one per village)	No.	0.15	0.150	10	0	1.5	1.5
15	Distribution of chaff cutter	No.	0.08	0.060	300	6	18	24
16	Animal identification							
i.	Tags	5000 Nos	0.00018	0.00018	3000	0	0.54	0.54
ii.	Needle	5000 Nos		0.000		0	0	0
iii.	Tag applicator	5000 Nos	0.015	0.015	5	0	0.075	0.075
17	Weighing balance	No.	0.01	0.010	300	0	3	3
18	Feed supplement distribution	No.	0.00126	0.001	18000	0	22.68	22.68
17	ICT Support for LLW/MF	No.	0.1	0.100	5	0	0.5	0.5
18	ILD centre	NO	10	10.000	0	0	0	0
	Sub total					16.44	232.765	249.205
II.	Market & value chain							
1	Formation of mtg (goat)	No.	0	0	20	0	0	0
2	Establishment of rural haat	No.	200	200	0	0	0	0
3	Clean milk production	No.	0.01	0.01	600		6	6
	Sub total						6	6
III.	Farmers Organisation & capacity Building							
1	MTG members Goat Management	No.	0.02763	0.02763	300	0	8.289	8.289
2	MTG members Refresher Goat Management	No.	0.00545	0.00545	300	0	1.635	1.635
3	LLW training	No.	0.075	0.075	5	0	0.375	0.375
4	Professional staff training	No.	0.075	0.075	10	0	0.75	0.75
5	Goat exhibition/seminar	No.	0.5	0.5	2	0	1	1
	Sub total					0	12.049	12.049
IV.	Project management & m&e							
1	Operating expenses of DD Office	No.	0.6	0.6	3	0	1.8	1.8
2	District Goat Development Plan Consultation (One at	No.	0	0	1	0	0	0

S. NO.	Items	Unit	Unit cost (Rs. In lac)	Assistance (Rs. In lac)	Physical	Total Financial (Rs. In Lacs)		
						Farmer Share	Project Cost	Total Cost
	each District)							
3	Vehicle on Hire for Cluster /POL	No.	1.8	1.8	3	0	5.4	5.4
4	Incentive for different project activities (Rs 1500 per capm)	No.	0.015	0.015	191	0	2.865	2.865
	Sub total					0	10.065	10.065
	Total					16.44	260.88	277.32

5.3. Market and value chains

The objective of this component is to enable farmers to engage in profitable market oriented production, that is sustainable, and to promote partnerships and market linkages with other value chain participants and agribusinesses. The component will help producer groups, agro enterprises, and commodity associations, to actively engage in the development of commodity value chains by partially financing demand-driven investment proposals to producer organization through a matching grant. This will be done by further organizing members of MTG and developing their capacity and skills for input and output marketing. It is expected that aggregation will bring economies of scale in procurement of inputs and marketing of agricultural produce, thus enabling wider access to markets. These producer organizations will be an important vehicle for promoting market-oriented production in their geographical jurisdiction and can act as centres for technology dissemination and input/output marketing. Project will develop (a) value chains aiming to establish longer term partnerships and market linkages between farmer groups and agribusiness enterprises, facilitated through an Agri-Business Promotion Facility (ABPF); and (b) alternate market channels. It is in this context that the FPCs that are developed may serve as input facilitators of seeds, pesticides etc. operators of common facilities by way of primary processing facilities, custom hiring (of farm equipment) facilitators, seed producers as well as platforms for B2B linkages directly with secondary processors/marketers.

5.3.1. Value chain studies of identified commodities in the cluster

As discussed in Chapter 3, following commodities are selected for the value chain intervention in the cluster, Bajra, Green gram and Isabgol. This was done based on broadly four set of parameters: 1) Existing size of the crop, 2) Potential for value addition, 3) Risk assessment and 4) Environmental parameter.

A comprehensive value chain study has been conducted that includes following activities, but not limited to: (i) participatory meetings with value chain stakeholders of each cluster such as – producers, aggregators, transport facilitators, storage facilitators, commission agents, wholesalers, retailers, (ii) analysis of potential for new value chains, volume & value of the selected crop with respect to its production, postharvest management practices, processing, storage, transport and marketing), (iv) analysis of the data / information collected from various sources, (v) feedback from market participants & relevant agencies, (vi) understanding on the role of stakeholders (vii) cost contribution analysis per stakeholder wise (viii) Margins at each level of value addition (ix) study gaps and issues in value chains (x) suggested intervention (xi) SWOT analysis for each value chain for intervention. (xiii) Comparative study of stakeholders' role and cost contribution in each cluster separately.

5.3.2. Value chain analysis and key opportunities

As discussed in the chapter 4, there is scope in the selected crops for value chain interventions. As mentioned, intervention can be started with primary processing at common facilities (FCSC). Thus the income of farmers can be increased by 25% instantly.

1. Bajra

The concept of FPC as suggested in Chapter 4, will get complimented by an FCSC unit. A reference value chain map of Bajra, post intervention along with the incremental benefit by comparing the traditional marketing chain of farmer with a suggested marketing chain, is shown in Annexure 5.3.

Farmers are exploited by traders based on the quality of the produce brought. Processors are willing to pay a premium based on FAQ (Fair Average Quality) parameters. Hence a small cleaning and grading unit can increase the returns by 20% because apart from getting premium, farmers will also save on the expenses as a result of aggregation. Farmers can then sell their cleaned and graded produce directly to processors. A warehouse along with the cleaning and grading unit can ensure longer use of the unit and can also cater the price volatility so that farmers need not go for distress sale.

2. Green gram

The concept of FPC as suggested in Chapter 4, will get complimented by an FCSC unit. A reference value chain map of pulses, post intervention, is shown in Annexure 5.3.

Farmers are exploited by traders based on the quality of the produce brought. Processors are willing to pay a premium based on FAQ (Fair Average Quality) parameters. Hence a small cleaning and grading unit can increase the returns by 20% because apart from getting premium, farmers will also save on the expenses as a result of aggregation. Farmers can then sell their cleaned and graded produce directly to processors. A mini dal mill with the cleaning and grading unit can ensure premium use of the unit.

3. Isabgol

Value chain map of Isabgol, post intervention is shown in Annexure 5.3.

Due to very less processing units in the state, Isabgol is transported to Oonjha mandi in Gujarat. Large volume export is done of Isabgol husk and the seeds which remain are used in cattle feed manufacturing industry. A small dehusking unit at the cluster level can save transportation expenses and hence can fetch additional 20%-30% rates from the husk buyers.

4. Goat milk

The cluster has scope for establishing milk collection , chilling and processing unit. As mentioned in the situational analysis section, the capacity of small milk processing unit can be 500-1000 litres per day and following activities will be performed:

- Milk collection (weighing scale, milk testing equipment and other utensils)
- Chilling section/ chiller
- Other required equipment for Value addition

Apart from the hard intervention, there is a need of soft interventions too. Based on the FPC model approach as discussed in Chapter 4, there is a requirement of other activities as listed below and a detailed description is in Annexure 5.4.

- Scouting of technologies and business ideas for identified commodities
- Incubation services to agri entrepreneurs
- Management and business training to FCSC and producer company personnel
- Facilitating reforms in agri policies

5.3.3. Value chain cost estimate

To promote Farmers' Producer Company along with the development of farmer common service center, it would require a support from the project as discussed below.

FPC registration and related licenses

Registration fees along with the fees of the facilitator can be budget under this amount. This component can also cover the fees to apply for other licenses as well like electricity, procurement etc. 100% assistance is required from the project as it is just the starting of the FPC hence there would be no other source of cash inflow for the unit.

S. No.	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Phy.	Financial		
							Farmer share	Project	Total
i)	Registration expenses and other pre-operative expenses- FPC	FPC	1	100%	1	4	0	4	4

Human Resource

Dedicated resource person is required at each FPC to manage and control day to day activities along with other compliances and business as well. 100% assistance is required in manpower.

S. No.	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Phy.	Financial		
							Farmer share	Project	Total
ii)	Manpower Expenses - FPC (Rs. 25,000 per month for 2 years)	FPC	6	100%	6	4	0	24	24

Office infrastructure

An office can be set up in a rented building with basic amenities like table, chair, computer, printer etc. Office is purely on the brand building basis to show the identity of the FPC hence a 50% support can be given by the project.

S. No.	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Phy.	Financial		
							Farmer share	Project	Total
iii)	Office Establishment (only physical assets like chair, tables, computer, printer and other furniture)	FPC	1	50%	0.5	4	2	2	4

Common Facility

This is the component for the establishment of the common facility infrastructure. On an average and also as per the business models suggested in the previous section an FCSC along with an FPC has a capital expenditure of Rs. 30 lakh. It can be taken as a standard by the project to assist any unit by 75% or Rs. 22.5 lakh whichever is lesser.

S. No.	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Phy.	Financial		
							Farmer share	Project	Total
1	Value Added Unit (Common Facility) - FPC	FPC	30	75%	22.5	4	30	90	120
2	Value added unit-Goat	FCSC	25	75%	18.75	1	6.25	18.75	25

Team ABPF will support this startup in preparation of bankable proposals and will provide technical support in formation of the unit and will guide the investor periodically.

S. No.	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Phy.	Financial		
							Farmer share	Project	Total
1	Start up	Private	20	0%	0	4	80	0	80

S. No.	Name of sub-component / Activity	Unit	Unit cost	Assistance (%)	Amount of Assistance	Phy.	Financial		
							Farmer share	Project	Total
	Sub Component 2B: Market Infrastructure and Agribusiness Support								
1	Nurturing farmers group								
i)	Registration expenses and other pre-operative expenses- FPC	FPC	1	100%	1	4	0	4	4
ii)	Manpower Expenses - FPC (Rs. 25,000 per month for 2 years)	FPC	6	100%	6	4	0	24	24
iii)	Office Establishment (only physical assets like chair, tables, computer, printer and other furniture)	FPC	1	50%	0.5	4	2	2	4
2a	Value Added Unit (Common Facility) - FPC	FPC	30	75%	22.5	4	30	90	120
2b	Value added unit- Goat	FCSC	25	100	25	1	0	25	25
3	Start up (Private investment)	Private	20	0%	0	4	80	0	80
	G. Total						112	145	257

5.3.4. Economic impact

The interventions proposed at the initial level are primary in nature and to build up the Agri business activities in the cluster. The process will lead to increase in business acumen of the farmers along with social and environmental development. At primary level, farmers can realize 15% - 20% more income at their farm.

With the model of FPC, there will be an advantage of aggregation which leads in cutting of cost hence increasing the income by 5%-10%. Members will also receive dividend on the profit earned by FPC through business hence, indicatively, farmer will get 35%-40% increased income once a full model of FPC and FCSC along with market linkages gets established.

An indicative profitability study for all the FCSC units proposed are as given below:

Table 19 Profitability indicators on proposed value chain units

Particulars	Green gram unit (Rs.)	Bajra CnG (Rs.)	Goat milk chilling unit (Rs.)
Revenue	9,333,360	1,536,000	4,015,000
Total Revenue	9,333,360	1,536,000	4,015,000
Fixed Cost (HR, other fixed cost)	979,500	383,000	221,000
Variable Cost	7,323,000	360,000	3,016,798

Particulars	Green gram unit (Rs.)	Bajra CnG (Rs.)	Goat milk chilling unit (Rs.)
Total Operational Expenses	8,302,500	743,000	3,237,798
Earning Before Interest, Depreciation, Taxes and Amortization (EBITDA)	1,030,860	793,000	777,202
Depreciation	247,500	268,500	142,388
Amortization	-	-	-
Earnings Before Interest and Taxes (EBIT)	783,360	524,500	634,815
Interest Expense	39,738	-	177,734
Earnings Before Taxes (EBT)	743,622	524,500	457,081
Tax (@ 30%)	183,429	157,350	137,124
Earnings After Taxes (EAT)	560,193	367,150	319,957
Financial Indicators			
Net Present Value (@ discount rate 10%)	499,066	132,293	897,873
Internal Rate of Return	15.25%	51.50%	25.50%
Payback period in years (Equity)	2.62	1.13	1
Payback period in years (Total)	3.50	3.91	3
Breakeven point	54.21%	45.45%	17.54%

Detailed Profit and loss statement for all the models including goat milk unit are given in Annexure 5.5.

5.3.5. Brief description of Implementing Arrangements

Above mentioned technological gaps would be addressed through various interventions suggested and through farmers groups (MTGs) formed under RACP. Group leaders of MTGs/MTAs can be trained on market led extension to spread adaption of technologies speedily. Also for better implementation role of ATMA, KVK would be crucial and they can be involved for registration of groups, trainings to farmers.

Implementation process for agri business units is proposed as follows:

1. Preparation of potential business model of units proposed above with the help of AB consulting agency.
2. Submission of project proposals to the PMU by the beneficiary.
3. Evaluation of projects by an appointed technical committee of PMU.
4. Approval of project by PMU/ EC RACPMIS for the proposed support through RACP.
5. Commissioning of the unit and business activity initiation
6. Phasing of subsidy during implementation:
 - a. 20% after mobilization of PC/entrepreneur fund
 - b. 40% during the purchase of the plant and machinery

- c. 40% at the commencement of the unit

5.4. Investment per unit of water saved per year

The comparison of investment (in Rs crore per mcm) is a useful tool for assessing data to understand the relative effectiveness and cost of the full spectrum of approaches to improving water security. When coupled with realistic assessments of operational risk, such comparisons can also help policy makers and investors to improve water-sector productivity.

In the case of Ladnun cluster, there are majorly two water saving activities taking place viz activities of Watershed department and the micro-irrigation system (MIS) activities of Agriculture and Horticulture department. Both these activities save water up to the extent of 0.28 mcm and 5.80 mcm per year respectively. When the investment per unit of water saved is calculated, it is found that Watershed activities are able to investment more amount of Rs.41.24 crores per mcm and MIS activities are able to conserve more water per investment of Rs1.10 crore per mcm of water per year. Thus, it could be said that in Ladnun, MIS activities like installation of drips and sprinklers for the agricultural and horticultural crops can be economic means of saving water in span of a year.

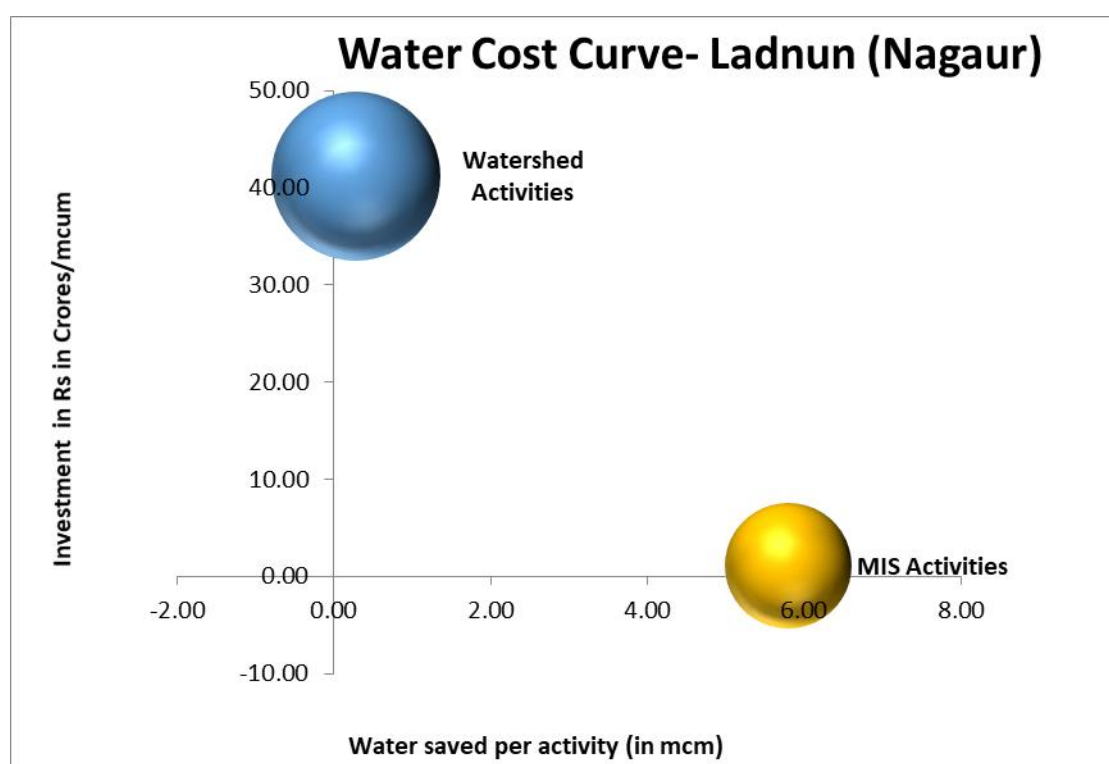


Figure 7 Investment (Rs crore/mcm) verses Water saved (mcm) per year

Table 20 Investment (Rs. crore/mcm) verses Water saved (mcm) per year

Activities undertaken to save water	Water saved- in mcm per year	Investment- Rs crore/mcm	Total investment- Rs crore
Watershed activities	0.28	41.24	11.55
MIS Activities	5.80	1.10	6.39

Chapter – 6: Watershed Development & Rain Water Management for Ground Water Recharge and addressing water demand

6.1 Description of watershed (Index Catchment) cluster

The Ladnun watershed (Index Catchment) cluster of RACP is located in Panchayat Samiti Ladnun, Nagaur district. There are 10 no. of villages situated in 5 Gram Panchayats in the Project area. The elevation is from 329-330 meters and slope range from 0-1%. This area is selected as Index Catchment; a hydrological unit for water management where no drainage lines are visible but rain water is conserved in a bowl shaped topographical feature.

6.2 Objectives of Water Management in the Cluster

- a. To promote the socio-economic development of the village community through optimum utilisation of natural resources of watershed,
- b. To conserve rainwater and vegetation effectively and harvest rain water into tankas in arable land for domestic purpose and the stored water may be utilized through drip irrigation.
- c. To promote sustainable farming and stabilise crop yields by adopting suitable crop management system. Thus increasing the production and yield per hectare,
- d. To cover the non-arable areas effectively through afforestation, horticulture and pastures based on land capability classification,
- e. To improve the economic and social conditions of the resource - poor and disadvantaged sections of the watershed community by employment generation and enhancing the income of individuals by adopting alternate enterprise.
- f. Restoration of ecological balance,

Thus, watershed development activities in rain-fed areas aim at conservation and management of natural resources on arable and non-arable lands to harvest and conserve rainwater, improve the productivity of crops, horticulture plantation, fuel and fodder resulting in increased income of Below Poverty Line (BPL) families, SC/ST, landless and marginal farmers, poverty alleviation and drought proofing.

6.3 Water Budgeting Exercise for the Project Area

The village-wise Area for water budgeting purpose (Potential Runoff contributing areas including upper forest lands within the micro watersheds, if any) is given in Annexure 6.1. The water budget is a basic tool that may be utilised to evaluate occurrence and movement of water through the natural environment. Water budget for a given area can be looked at as water inputs, outputs and changes in harvesting, recharge & storage. The inputs into the area of investigation (precipitation, groundwater or surface water inflows etc.) must be equal to the outputs (evapo-transpiration, water harvesting, and recharge, supply, abstractions, surface or groundwater outflows) as well as any changes in storage within the area. Water budgeting of watershed is necessary to work out the total number and

size of water harvesting structure, i.e. how much total runoff is available, out of which how much is being already stored in existing structures and also how much is available for further storage.

a. Estimation of Rainwater

The process to estimate runoff may be summarized as under:

Classification of Project Area based on inputs received from Revenue Record, GIS layers, and PRA exercise. The basis of the criteria is presented below:

Good Catchment – where maximum runoff & minimum infiltration like hillocks, plateau etc.

Average Catchment – cultivated land, forest land with vegetation.

Bad Catchment - where runoff is minimum and infiltration is maximum e.g. Sandy soil.

The Project area was categorised on the basis of information available in the land records.

S. No.	Catchment	Area in Ha
1	Bad Catchment	14527
	Total	14527

(i) **Average Annual Rainfall:** 413 mm (Data provided by Water Resource Deptt, Nagaur)

(ii) **Calculation of Runoff (Expected Yield) based on the “Strange-Table”**

Rating of Catchment	Characteristics	Coefficient in strange table (Cum/Ha) [1]	Area (in Hac) [2]	Expected Yield (in Cum) [1x2]
Bad	Runoff is minimum and infiltration is maximum e.g. Sandy soil	220	14527	3195940.00
Total			14527	3195940.00

(iii) **Estimation of water-storage in existing water harvesting structures situated in Project Area:-**

S. No.	Type of Structure	Nos.	Storage Capacity (In Cum)	Storage Capacity (% of Total Surface Runoff)
1	Tanka	200	5000	0.53%
2	Pakki Nadi (Johad)	7	11904.76	
	TOTAL		16904.76	

(iv) Above table reveals that a total of 16904.76 cum water is already being harvested tanka and Pakki Nadi (Johad) in the cluster. Now balance i.e. 3195940.00 cum-16904.76 cum (an approximate amount of runoff is 3179035.24 cum) to be harvested to cater the requirement of the crops to be grown in the area.

(v) **Calculation of the Balance Runoff:**

$$\text{Balance Runoff} = \text{Expected Yield (iii)} - \text{Present Storage Capacity (iv)}$$

$$\text{Balanced Runoff} = 3195940.00 \text{ cum} - 16904.76 \text{ cum} = 3179035.24 \text{ Cum}$$

(vi) **Proposed Project Activities/Structures:**

The activities/interventions presented below have been selected and proposed based on the outcomes of (i) the PRA exercise carried out in each project village (ii) Water budgeting carried out for the watershed (iii) Information gathered through DGPRS survey and GIS based thematic layers.

b. Proposed Project Activities/Structures for Arable Land

S. No.	Activity	Unit	Quantity	Storage Capacity (Cum)	Total Storage Capacity (Cum)
A.	Conservation measures for Arable land				
I	Tanka	Nos.	280	24.72	6921.60

S. No.	Activity	Unit	Quantity	Storage Capacity (Cum)	Total Storage Capacity (Cum)
2.	Tanka Type A	Nos.	332	41.68	13837.76
3.	Farm Pond	Nos.	20	4538.10	90762.00
	Total				111521.36

Note :- As per the on field Study Report of Dr. P. K. Singh, Professor and Head, Soil & Water Conservation Department, MPUAT, Udaipur, (Annexure- 6.2) recently carried out in 2015, as a general principle, the total ground water recharge during the entire season or per year is about 2-3 times of the total water storage capacity of the rain water harvesting structure. The Department of Watershed Development & Soil Conservation has adopted total ground water recharge (from Non Arable and Drainage lines treatment structures) as 2 times of the total storage capacity for all Water Harvesting Structures.

As per this 2 times of the total storage capacity = 111521.36 x 2 = 223042.70 cum

Total of likely ground water recharge from Arable Land activities (Cum) = 223042.70cum

In watershed clusters, during the course of implementation of field activities similar type of trials would be carried out with the support of the State Agricultural University.

c. Proposed Project Activities/Structures for Non-Arable Land & D.L.T.

S. No.	Activity	Unit	Quantity	Storage Capacity(Cum)	Total Storage Capacity (Cum)
1	Masonry Pond (Johar)	Nos.	1	1753.88	1753.88
2	ECD	Nos.	33	810.00	26730.00
	Grand Total (N.A.)				28483.88

Similarly, for above structures proposed structures, 2 times of the total storage capacity = 28483.88 x 2 = 56967.76 Cum

Total of likely ground water recharge from Arable Land + Non Arable Lands activities

$$= 223042.70 + 56967.76$$

$$= 280010.48 \text{ cum}$$

Remaining (still untapped) Runoff = i.e. 3179035.24-280010.48= 2899024.76 cum (Which is 90.71 % of Total Surface Runoff)

Expected Yield of Water	Present storage capacity	Balance Runoff to be utilized	Estimated Collective Storage Capacity of the Proposed Structures	Remaining Runoff (Still Untapped)
1	2	3 = (1 - 2)	4	5 = (3 - 4)
3195940.00 Cum	16904.76 Cum	3179035.24 Cum	280010.48 Cum	2899024.76 Cum
100%	0.53 %	99.47 %	8.76 %	90.71 %

Above table clearly shows that only **9.29 % (0.53+8.76)** rain water is proposed to be harvested and rest **90.71 %** rain water still to be untapped and allowed to flow to lower areas beyond the cluster.

6.4 Proposed Activities in the watershed cluster

The activities to be proposed in the watershed cluster is dependent on extent of the soil erosion and crops to be grown in the cluster so that soil erosion can be controlled and requirement of the crops of the cluster could be met out. Although Kharif crops are grown in rainfed areas but for getting more production lifesaving irrigation has to be applied on the crops. Similarly, in Rabi crops, the crop requirement is to be catered either from ground water or from harvested water done through

farm ponds and other water storage structures needed in the area. Keeping this in view, field survey has been undertaken in the cluster and is summarized herewith.

Participatory Rural Appraisal (PRA)

A field level survey using Participatory Rural Appraisal (PRA) has been carried out by the project team and estimation of field level findings has been identified.

Participatory Rural Appraisal (PRA) is a systemic tool for intensive action with community members to facilitate collection, analysis and understanding needs/problems of their community. PRA emphasizes local knowledge and involves communities in inventing, monitoring, and planning of local resources. The PRA approach relies heavily on visualization, diagramming and people participation. It provides information to outsiders who wish to understand how the community uses and manages its own resources. PRA activity empowers marginalized communities, de-emphasizes hierarchies, and helps identify resource needs and its sustainable use.

PRA Outcome - SWOT Analysis

SWOT analysis was performed for the project area to identify the strengths, weaknesses, opportunities and threats in the context of the RACP project so that strategic planning can be pursued to improve the prevailing condition.

Strength	Weakness
<ul style="list-style-type: none"> ➤ The project area is blessed in terms of fertility of land resources. ➤ Most of the villages in the Project Area are located in the vicinity of 10-15 kms of Nagaur-Seekar NH-65 that enables better access to urban centres such as Nagaur, Sujangarh, Ladnun. 	<ul style="list-style-type: none"> ➤ Lack of diversity in livelihood sources, as agriculture and Animal Husbandry are the only major sources of livelihood. This situation compels the villagers to work as daily labourers in the urban areas and even migrate to urban areas during drought periods. ➤ Weak or absence of village level community based organization / farmers groups presented in the project area. ➤ Dismal level of literacy and awareness in the Project villages resulting in lack of transformation on agriculture and other livelihood practices, poor awareness about government schemes related to agriculture/horticulture etc.
Opportunity	Threat
<ul style="list-style-type: none"> ➤ Most of the places soil quality is very good, rich in organic matter in growth; has good potential for increase in production and productivity with better input management and water use. ➤ Very good access to adjoining urban areas through the adjoining NH offers tremendous opportunity for effective marketing of the agriculture and milk produce in nearby cities. ➤ Effective implementation of watershed development activities can potentially enhance the productivity of land resources in the project area and thereby transform 	<ul style="list-style-type: none"> ➤ Dependence on rains for agriculture makes the economy of the entire project area bit challenging ➤ Limited road infrastructure may result into delay in supply and demand chain management. ➤ How to increase the productivity in small land holdings is a issue. ➤ Most of the tribal population has poor literacy ➤ Proximity with urban centres may cause are strong chances of increased rate of migration causing socio-cultural problems.

the economy of the entire area by increased production of crops, vegetables, fruits, milk etc.	
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6.5 Watershed Development Activities

Apart from need based training, workshops, capacity building, IEC and exposure visit activities, WD&SC Department will carry out Hydrological Monitoring Networks (HMN) at the cluster level and instruments like automatic rain gauge & instruments housing facility etc. shall be provided. A provision of Rs. 31.96 Lakh is being kept in CACP.

In addition to this, to enable the DPR/CACP Sub Plan preparation, Field Surveys, PRA was done, baseline data, secondary data, revenue record was collected and Thematic Layers i.e. Khasra map on watershed map, Present Land use and land cover, digital elevation model (DEM) using Remote Sensing & Geographical Information System (RS&GIS) are procured, analysed & scientifically used.

Based on need of the area and runoff to be harvested, various watershed activities are taken up for in-situ moisture conservation, water harvesting, and water recharge. This will ensure growth of Kharif crops from in-situ moisture & harvested water to support lifesaving irrigation and most importantly contributing to ground water recharge and to the water balance.

Keeping these factors in mind, details of field level location specific and need based watershed activities to be carried out in Ladnun and expected beneficiaries/outcome are presented under the following activities proposed for watershed development.

S. No.	Activity	Description	Water Recharged/ Harvested (Cum)	Beneficiaries (Nos)
1.	Tanka	Tanka are constructed in sandy soil because sandy soil have high infiltration rate. Tanka is mainly storage structure.by construction, 280 unit in arable land with proposed financial cost Rs.356.99 farmer will be used drinking water	13843.20	280
2.	Tanka Type A	Tanka A are constructed in sandy soil because sandy soil have high infiltration rate. Tanka is mainly storage structure, by construction, 332 unit in arable land with proposed financial cost Rs.498.00, farmer will be used drinking water	27675.52	332
3.	Farm Pond	1. Farm Ponds, at a lower elevation, are constructed to harvest the excess runoff after in-situ moisture conservation. Farm pond helps in providing supplemental irrigation as well as increasing cropping intensity. By constructing 20 Farm Pond in arable & Non-arable land with proposed financial cost Rs. 200.00 lacs runoff will harvested for irrigation use	181524	20
4.	Plantation (Agro-Forestry)	To increased productivity, economic benefits, and more diversity in the ecological goods. 1425 plants with proposed financial cost Rs. 0.46 lacs	-	612
5.	Azola unit	Azola activity is proposed to be available in summer for Livestock feeding to increase milk production. By constructing 16 Azola unit in arable land with proposed financial cost Rs. 2.97 lacs cultivators will benefitted having alternative income & livestock feeding source	-	11
6.	Masonry pond (Johar)	Masonry Pond (Johar) are constructed in sandy loam soil because sand soil high infiltration rate. Masonry Pond (Johar) is mainly storage structure by construction 1 units in arable land with proposed financial cost Rs. 18.86 lacs.	3507.76	-
		Earthen Check Dam activity is proposed to harvest	53460	Users

S. No.	Activity	Description	Water Recharged/ Harvested (Cum)	Beneficiaries (Nos)
7.	Earthen Check Dam	& infiltration of runoff in Drainage line of Ist & IInd order. By constructing 33 Earthen Check Dam structures in arable & Non-arable land with proposed financial cost Rs. 2.64 lacs runoff will harvested for irrigation use		Groups
8.	Pasture land development	<ol style="list-style-type: none"> 1. Fencing of Pasture Lands:- fencing of the area by ditch cum bund supported by vegetative measures. 2. Tree plantation on all un-cultivated Non arable/ Pasture lands to develop a three tier canopy. 3. Over-seeding of grass seeds in pasture land areas:- Broadcasting of locally suited palatable grass seed like Sevan, Dhaman, Stylosanthes Hamata etc Pasture Development activities will carried out in 5 hac with Rs. 4.29 lacs.	-	Users Groups

The Department of Watershed Development & Soil Conservation has Technical Manual for watershed activities into operation state-wide and all the details of activities, justification, technical parameters, location specific requirements etc. are available with the PIA-District/Clusters.

During the planning process of CACP Ladnun, the proposed locations of all the interventions have been finalised in consultation with the MTG members/beneficiaries, users groups and other concerned stake holders and activity locations are geo-tagged with longitude and latitudes. At the time of concurrent monitoring during implementation of activities, these geo-tags will be referred for random quality checks also.

6.6 Implementation Strategy for execution of Watershed Development Works

However, separate detailed **Operational Guidelines** for Watershed Development & Soil Conservation activities has been issued; still some important strategic aspects are enumerated as under:

a. Approach for implementation of Watershed Works under RACP as per MJSA

Under Mukhyamatri Jal Swablamban Abhiyan (MJSA), the works are carried out through contractors and machines both Arable, Non Arable and DLT on "Four Waters Concept" and ensuring higher technical requirements, quality skills and timely execution of activities. There are two types of scenario i.e. shopping & N.C.B. which are being done at the level of District level Officers of the WD&SC Department and accordingly procurement plan is being prepared by the Department and being submitted to the World Bank through STEP.

b. Beneficiary's Contribution and involvement:

Under the RACP, farmer's contribution is an integral part of project cost besides World Bank and State Government's contribution in order to ascertain the belongingness of the local community. There is a beneficiary contribution of **10% for S & M farmers and 20% for others farmers** in all individual watershed activities. These contributions would be acceptable in Cash/Labour/Material. There will be no beneficiary contribution for activities on common / Panchayat land.

One of the major strengths of the RACP is that one dedicated NGO having technical team and community organizers has been deployed to carry out data collection, community mobilization, training, IEC, social screening, need based technical support to the PIAs of all line departments. It is strengthening the linkage between the contractors and community, its participation, sustainability and ownership of assets created.

c. Broad Approach followed for selecting and design of proposed structures:

- GIS Based thematic layers (Maps) prepared on the basis of high resolution NRSA data.

- b. GIS based Flow Accumulation layer utilised to estimate water accumulation at various points/locations and the corresponding catchment areas for each such location.
- c. GIS based Slop Layer utilised to assess the land slope at various points of the project area so as to choose appropriate structures/interventions based on the land slope as well
- d. GIS based Drainage/Water-Bodies layer utilised to mark the location and required dimensions of drains and water bodies
- e. Reconnaissance survey carried out for location of *Nallah* marked on the drainage/water-bodies GIS layer and *Nallah* figure correctly marked on the map
- f. GIS based Land-Use-Land-Cover layer utilised to access usages of the land and accordingly selection of appropriate location for various structures
- g. GIS based *Khasra* layer utilised for identification of locations for construction of the proposed structures identified based on potential for water storage and size of the land parcels
- h. Inputs received from the community during the PRA exercise carried out in all 10 project villages were considered for deciding the nature and location of the structures
- i. Standard criteria and formats being followed by the Department of Watershed, Government of Rajasthan, adopted for the purpose of designing structures.
- j. Latest BSR of PR&RD, P.S. Ladnun, District Nagaur & Irrigation Department Nagaur adopted for estimation of item-wise costs for the proposed interventions.

6.7 Estimated Cost of Investments under Watershed Management

The total project period details of activities / measures / works / structures proposed in Ladnun cluster are as under:

Table 21 Proposed Interventions under Watershed Development & Soil Conservation

S. No.	Name of Activity	Unit Cost	Unit	Total of New CACP provisions	
				Phy.	Fin.
1	Component 1: Climatic Resilient Agriculture				
1A	Sub Component 1A : Improving Water use efficiency				
	Physical Activities :				
1.1	Watershed Sub Plan of Cluster Agricultural Competitiveness Plan (CACP)				11.62
1.2	Hydrological Monitoring Network (HNM) & Crop Water Budgeting (CWB) Etc.				50.00
1.3	ACTIVITIES ON ARABLE LAND				
1.3.1	Arable Conservation Measure				
1	Tanka	1.27	Nos.	280	356.99
2	Tanka Type A	1.50	Nos.	332	498.00
3	Farm Pond	10.00	Nos.	20	200.00
	Total 1.3.1				1054.99
1.3.1	Arable Production Measure				
1	Plantation (Agroforestry)	0.00032	Nos.	1425	0.46
2	Azola	0.19	Nos.	16	2.97
	Total 1.3.2				3.43
	Total Arable 1.3.1 +1.3.2				1058.42

S. No.	Name of Activity	Unit Cost	Unit	Total of New CACP provisions	
				Phy.	Fin.
1.4	ACTIVITIES ON NON ARABLE LANDS				
1.4.1	Non-Arable Conservation Measure				
1	Masonry Pond (Johar)	18.86	Nos.	1	18.86
2	ECD (Earthen Check Dam)	0.08	Nos.	33	2.64
	Total 1.4.1				21.51
1.4.2	Non-Arable Production Measure				
1	Pasture Development	0.858	Ha.	5	4.29
	Total 1.4.2				4.29
	Total Non-Arable (1.4.1+1.4.2)				25.79
1.5	Drainage Line Treatment				
	Total D.L.T. 1.5				0.00
	Grand Total NRM Measures (1.3+1.4+1.5)				1084.21
1.6	Consolidation of Works				8.72
	Total 1 (1.1 to 1.6)				1154.55
2	Component 2 : Markets and value chain				
3	Component 3 : Farmer Organization & Capacity building				
3.1	Community Mobilization, IEC, Group Formation, training, Capacity Building				21.79
	Sub Total 3				21.79
4	Component 4 : Project Management, Monitoring and Learning				
4.1	District + PIA Level Operating Costs including Photostat, computer typing & printing, fax, mobility (hired taxi/POL), TA/DA etc.				20.00
	Sub Total 4				35.00
	Grand Total (1+2+3+4)				1196.34

Site Specific Plan & Cost estimates

The measures / works / structures as discussed above are proposed to be executed / constructed / implemented to harvest the rain water during the monsoon to the benefit of farmers so that crops can be grown satisfactorily in the cluster and productivity of crops may be increased accordingly.

The farm level plans of all individual activities have been prepared by the PIA and his team. The list of farmers with all the details including longitude and latitude, where the work / structures are proposed are collected, geo tagged are available before start of implementation.

The site Specific designs, plan and cost estimates of all the activities are prepared in detail and are available with the PIA-Ladnun-Watershed.

6.8 Implementation Arrangement for all the planned activities in the watershed Area

Planning and implementation of the project activities is being undertaken by the line department i.e. that of Watershed Development and Soil Conservation with the support of dedicated Project Implementation Unit (PIU) of the department. The implementation structure at the state, district, cluster and community level for implementation and monitoring for all the planned activities in the watershed Area under the project is described below:

At the State level, in addition to the Steering Committee i.e. Apex Body & Executive Committee, a Project Management Unit (PMU) has been established under the society i.e. RACPMIS and dedicated Project Implementation Unit (PIU). The PMU & PIU will be having effective coordination and provide a robust governance and coordination mechanism for the project. To support livestock activities and supply of bucks, the Rajasthan University of Veterinary and Animal Sciences (RAJUVAS), Bikaner has been added in the project as Partner Agency and similarly a MOU has been signed with the ARAVALI for support in community mobilization and other training activities for the project.

At District Level: A district level Project Implementation Agency (PIA) has been assigned for planning and implementation of project activities in the cluster. Although one District Coordinator (Watershed Engineer) has been deputed with the PIA, the Project Manager and his office has been designated by the department for implementation of the watershed management activities in the cluster. This is with the support of PRIs and field level NGO under overall supervision of PIU and District-Level Implementation Committee (DLIC). DLIC is headed by the District Collector with District Project Manager (RACP) as member secretary already established under the RACPMIS. DLIC will also maintain convergence at the district, Zilla Parishad level to PRIs at block and GP level. The linkage between the PRIs and the project is critical so that no conflict situation arises between the PRIs and different community level organizations set up within the RACP.

At the Cluster Level: A field level NGO has been deployed in the cluster to support implementation of technical activities in the cluster. In addition to the Team Leader, Community Mobilization Specialist, Community Organizers, a Watershed Assistant is with the NGO to support field level activities in the cluster. As per the operational guidelines issued under the project, the Multi Task Groups, Multi Task Associations, User's Groups and Farmer Producer Company are being formed in the cluster. Participation of these Institutions would be ensured in implementation of the project activities to maintain quality and quantity. For support of other technical activities in the cluster the Agriculture, Horticulture and Livestock Assistant are also deployed with the NGO to support related activities in the cluster. A contractor would also be contracted to implement the activities for Natural Resources Management in the cluster.

Chapter – 7: Social & Environmental Management Plan

7.1. Social Management Plan (SMP)

The SMP is described to minimise or mitigate any adverse social and livelihood impacts emanating from various sub-projects supported by the RACP project. The SMP will be used for developing appropriate social mitigation strategies, and mechanisms for minimizing the risks and expected adverse impacts. In addition, the SMP also includes strategies for consultation and participation, social mobilisation and inclusion, gender and women's empowerment and social risk management.

The SMP therefore provides guidelines to assess the social impact of all the sub-projects and design cluster-specific plans, including the tribal development plan and the resettlement/ rehabilitation assistance plans. Overall, the SMP aims to avoid/minimize risks, avoid exacerbation of social and economic disparities between and among social groups, ensure equitable spread of project investments and benefits, and contribute to long-term social and institutional sustainability of the RACP.

SMP consists of the following strategies:

- Social baseline information
- Consultant held - Key social issue of cluster
- Social mobilisation strategy
- Targeting and beneficiary selection criteria for project goods/services
- Subproject require social impact screening and rehabilitation assistance

Social baseline information Ladnun Cluster:-

Project Area covers an area of 14527 hectare (ha) comprising five (5) Gram Panchayats and ten (10) villages. The Cluster village has a population of 26,323 of which 13,739 are males while 12,584 are females as per field survey by NGOs. In the cluster scheduled caste 5848 and scheduled tribe category only 5 population. Cluster had household of 4288 of which of which small farmer 1122, marginal farmer 1006, large farmer 1377 and remaining farmer landless.

Consultation held - Key social issue of the Cluster

Major issues in cluster that emerged from the farmer and group consultations during field visit are summarized below.

- a. Women folk believe that though they do most of the work in agriculture except for ploughing and selling, they have no role in decision making regarding purchase of inputs or selling of produce.
- b. Women are not recognized as farmers in their own right.
- c. Problem of access to credit by small and marginal farmers.
- d. Lack of timely supply of agriculture inputs including seed and fertilizers.
- e. Marginalization of small and marginal farmers in technologies and investments, training and capacity building.

- f. Lack of breed improvement and livestock health care services.
- g. Outreach of extension services very low in villages.
- h. Community based organizations (multi task groups, multi task group - goat) should be integrated into the Farmer Producer Companies (FPC) that will be facilitated in the RACP.

The project does not envisage acquisition of any private land for purposes of storage, processing or any other activity. There will be no adverse impacts related to land acquisition. Therefore abbreviated resettlement plan does not require at cluster level. The detailed social management plan can be referred from Annexure 7.1.

7.2. Environment Management Plan (EMP)

The key interventions under RACP can be grouped as under:-

- Crop intensification
- Water Management
- Livestock Management
- Value chain development activities

Environment Management Plan for Crop Intensification/Water management /Livestock Management/ Value Chain development activities

The key objective of interventions in crop production is to increase crop productivity so that farmer income is also enhanced. The dominant and “business-as-usual” approach to achieving this is to intensify crop production by introducing hybrid seed varieties that respond well to chemical fertilizers and apply chemical pesticides to control pests and diseases that attack the crop. The RACP proposes to adopt “green” agricultural practices that would promote Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) and therefore, the possibility of excessive use of agri-chemicals is largely mitigated.

Water harvesting and water management activities are expected to be implemented in the RACP, namely, rain fed, groundwater based and surface water based. The main objectives are to harvest and store water in rain fed systems, harvest and recharge in groundwater systems and under all water regimes to sustainably use water for cropping and livestock, reduce use of water in agriculture sector and increase water-use efficiency in cropping.

The project proposes to provide health care through organizing Animal Health Camps and also by providing permanent services through a Rural Technology Centre-cum-Animal Health Centre. The likely impacts of these are issues related to safe disposal of syringes, needles and vaccines used in treating the animals.

Storage and processing of produce are activities expected to be taken up under value chain development component of the RACP. The operations include input supply to its members, output marketing and processing support to its members, providing warehousing facility, Food processing Unit, etc. These activities when carried out in a “business-as-usual” manner would affect the environment in one way or the other.

The Line Department /NGO/ Design consultants/engineers /FPC for designing and executing the structures will abide by the Environmental measures listed in the Environment Management Plan (EMP) given below. The Line Department shall include the EMP requirements in the Programme of RACP Works. The requirements stated in the EMP should therefore be studied properly and implemented accordingly.

Details can be referred in Annexure 7.2.

Chapter – 8: Consolidated investment plan with budget and source of funds

8.1. Procurement and Financial Management

The financial management and procurement aspects are at the core and are stated in the Loan Agreement, Project Agreement, Disbursement Letter and detailed in the Project Financial Management Manual (PFMM) and Project Procurement Manual (PPM). Accordingly both the PFMM and PPM have already been shared with all agencies (The PMU, DPMU, Jaipur the six Line departments and partner agencies) to ensure consistency and compliance. While the Financial Management aspects include: Planning and Budgeting, Funds Flow, Accounting, Reporting, Internal Control, including internal Audit and External Audit the Procurement aspects include procurement planning, use of standard bid documents, contract management aspects and procurement prior and post review based on threshold in agreed procurement plan.

The procurement is done as per the procurement plan approved by the World Bank and Procurement Manual & World Bank Procurement Guidelines are followed. As far as fund flow management is concerned, fund management is done as per the Financial Management Manual.

Financial Management and Procurement Framework for releases of funds to MTAs/FPCs/Individual Beneficiaries (IBs) under grants, as mentioned above the procurement will be done as per the Procurement Management Manual (PMM) and fund flow will be done as per the Financial Management Manual (FMM). In this cluster, MTAs have been formed and Farmer Producer's Companies (FPCs) are to be formed. The related activities are to be performed by these MTAs/FPCs/Individual Beneficiaries (IBs). A Community Resource Person (CRP) is being deployed with each of the MTAs and Chief Executive Officer (CEO) is to be deployed with each of the FPC in the cluster. These CRPs/CEOs will be paid based on the performance. The certain works have been assigned to them to be performed by them. Following actions are needed:

- A fiduciary capacity assessment of MTAs/FPCs/IBs shall be carried out by the Bank. (This shall be completed by assessing a representative sample of MTAs/FPCs/IBs, as determined by the Bank.)
- Based on the completed assessment, appropriate mitigation measures, including issuing the fiduciary guidelines; availability of procurement and financial management point person at their level and capacity building shall be adopted.
- Some activities like institutional & infrastructure support to Farmer's Producer Companies and Post-Harvest Management support to be given to individual farmers which are to be

treated as grant in Agriculture and Horticulture departments. Upon verification that above actions have been completed, funds flow to MTAs/FPCs/IBs through Grants under approved sub projects as part of the CACPs can be initiated

8.2. Investment Plan

The **consolidated investment plan** has been explained in the concerned chapters to make the area and farmers of the cluster competitive so that they can get optimum water as well crop's productivity. An estimated consolidated investment amount of **Rs.3446.35 lakh** would be incurred on various activities. The source of funds is credit available in components of Rajasthan Agricultural Competitiveness Project (RACP). The department, major activity and component wise investment plan with budget are being summarized as under:

Table 22: Consolidated Investment Plan

S. No.	Department	Components (Rs. Lakh)				
		Climate Resilient Agriculture	Market & Value Chains	Farmer's Organization and Capacity Building	Project Management and M&E	Total
1	Watershed Development & Soil Conservation	1154.55	0	21.79	20.00	1196.34
021	Agriculture	990.56	232.00	123.33	9.00	1354.89
3	Horticulture	545.80	-	36.00	11.00	592.80
4	Animal Husbandry	249.21	31.00	12.05	10.07	302.32
	Total	2940.12	263.00	193.17	50.07	3446.35

Above table reveals that investments related to improvement of water use efficiency, transfer of technology and market led advisory services, livestock strengthening, market infrastructure and value chain development an estimated total amount of **Rs.3446.35 lakh** likely to be incurred in the cluster to make the farmer and cluster competitive and to maximize water as well as agricultural productivity in the cluster.

8.2.1. Consolidated Investment Plan – by nature of expenditure:

Investments related to improvement of water use efficiency, transfer of technology and market led advisory services, livestock strengthening, market infrastructure and value chain development an estimated total amount of **Rs.3446.35 lacs** likely to be incurred in the cluster to make the farmer and cluster competitive and to maximize water as well as agricultural productivity in the cluster.

Table 23: Consolidated Investment Plan – by nature of expenditure

Type of Expenditure/ Line Dept.	Watershed Management	Agriculture	Horticulture	Animal Husbandry	Total
Goods	0	726.24	391.78	153.96	1271.98
Works	965.92	2.22	0.00	90.00	1058.14
Consultant Services	61.62	102.00	0.00	0.00	163.62
Operating Costs	20.00	16.51	11.00	29.87	77.38
Training	21.79	23.33	36.00	12.05	93.17
Grants	0	116.00	0.00	0.00	116
Beneficiary Contribution	127.01	368.59	154.02	16.44	666.06
Total	1196.34	1354.89	592.80	302.33	3446.35

Note:

1. The column for “Grants” would state project’s share for any goods/services provided to WUAs/MTAs/FPCs/IBs and column for “Beneficiary contribution” will include share of WUAs/MTAs/FPCs/IB.
2. The proposed activities in the CACP will be implemented as per the subject specific operational guidelines already approved. The revisions in the guidelines have been made as per the reply sent to the World Bank and committed during the Mid Term Review (MTR) and approved in the meetings of Executive Committee held till now. If any change in subject specific operational guidelines in future is to be made during the course of implementation, then it would be applicable accordingly.

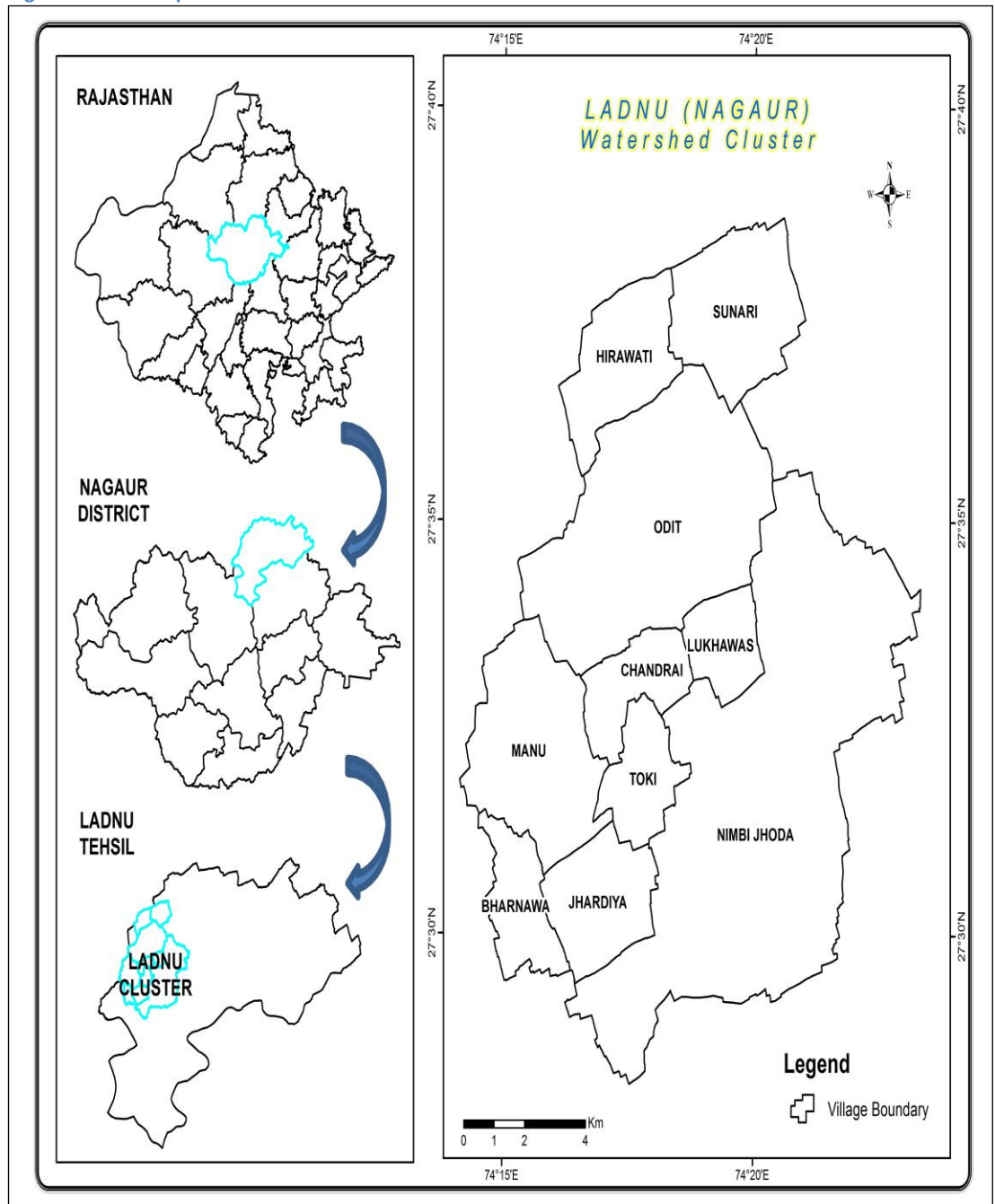
Annexure 2.1 Gram Panchayat and Village-wise area in Ladnun Cluster

Table 24 Gram Panchayat and Village wise area in Ladnun Cluster

S. No.	Name of Village Panchayat	Name of Villages Covered	Census code of villages	Area (In Ha.)
1	Nimbi Jodha	Nimbi Jodha	082368	6115
2	Hudas	Bharnawa	082365	86
3	Chandrai	Chandrai	082570	616
		Manu	082363	1701
		Jhardiya	082366	873
		Toki	082367	90
4	Odeent	Odeent	082371	2867
		Heerawati	082373	947
		Lukash	082369	473
5	Sunari	Sunari	082374	759
		TOTAL		14527

(Source: Watershed DPR of Ladnun Cluster)

Figure 8: Index Map of Ladnun cluster



Annexure 2.2 Trend of change in cropped area and cropping over 10 years in Rajasthan & Nagaur district

Table 25: Area (in ha %) of Agricultural Crops in 2006-07 & 2015-16, increase / decrease over 10 years in State & Nagaur district

Crops	2006-07		2015-16		Increase (+)/Decrease (-) over 10 Years		Average of 10 Years	2006-07		2015-16		Increase (+)/Decrease (-) over 10 Years		Average of 10 Years	% over state average
	Area (ha)	%	Area (ha)	%	Area (ha)	%		Area (ha)	%	Area (ha)	%	Area (ha)	%		
Green Gram	759454	4.30%	1363989	7.72%	604535	3.42%	1001942	211791	16.71%	381622	30.12%	169831	13.40%	270921.3	27.04%
Sorghum	662055	3.74%	631170	3.57%	-30885	-0.17%	641570.1	53787	4.24%	46767	3.69%	-7020	-0.55%	57075.4	8.90%
Pearl Millet	4910409	27.78%	4044591	22.88%	-865818	-4.90%	4739211	461777	36.44%	353028	27.86%	-108749	-8.58%	440318.2	9.29%
Wheat	2564840	14.51%	3108973	17.59%	544133	3.08%	2851321.6	76384	6.03%	60279	4.76%	-16105	-1.27%	72561.7	2.54%

Barley	232271	1.31%	256029	1.45%	23758	0.13%	281434.6	11918	0.94%	9333	0.74%	-2585	-0.20%	12726.5	4.52%
Gram	1010754	5.72%	941950	5.33%	-68804	-0.39%	1297770.4	17454	1.38%	8069	0.64%	-9385	-0.74%	33125.7	2.55%
Isabgol	158035	0.89%	304430	1.72%	146395	0.83%	215409.3	31628	2.50%	40046	3.16%	8418	0.66%	37280.4	17.31%
Sesamum	273345	1.55%	366736	2.07%	93391	0.53%	424089	10837	0.86%	11176	0.88%	339	0.03%	17951	4.23%
Mustard	3099570	17.53%	2532330	14.32%	-567240	-3.21%	2561288.3	98538	7.78%	58569	4.62%	-39969	-3.15%	65974.8	2.58%
Taramira	112107	0.63%	16792	0.09%	-95315	-0.54%	206125	5708	0.45%	841	0.07%	-4867	-0.38%	54326.9	26.36%
Cumin	149816	0.85%	511078	2.89%	361262	2.04%	324727.6	12424	0.98%	49645	3.92%	37221	2.94%	33846.8	10.42%

(Source: Agriculture department, Nagaur)

Table 26: Cropping Pattern (%) for 10 Years (2006-07 to 2015-16) at the State level

Crops	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	% Average of 10 Years
Kharif											
Green Gram	4.30%	6.20%	5.05%	5.44%	5.72%	7.05%	4.53%	5.58%	5.06%	7.72%	3.63%
Pearl Millet	27.78%	29.70%	29.66%	30.45%	30.08%	27.65%	22.82%	24.16%	23.06%	22.88%	26.81%
Sorghum	3.74%	3.66%	3.29%	4.23%	3.96%	3.07%	3.89%	3.17%	3.74%	3.57%	3.63%
Sesamum	1.55%	1.84%	2.97%	3.52%	2.99%	2.84%	2.38%	1.97%	1.87%	2.07%	2.40%
Rabi											
Mustard	17.53%	14.38%	15.60%	13.03%	13.57%	13.54%	13.87%	15.23%	13.77%	14.32%	14.49%
Wheat	14.51%	15.16%	13.08%	14.10%	16.55%	16.28%	17.53%	17.55%	18.77%	17.59%	16.13%
Gram	5.72%	7.20%	7.18%	5.21%	9.72%	7.95%	7.17%	10.53%	7.11%	5.33%	7.34%
Barley	1.31%	1.46%	1.63%	1.32%	1.79%	1.54%	1.76%	1.69%	1.94%	1.45%	1.59%
Isabgol	0.89%	0.80%	0.91%	1.34%	1.17%	1.23%	1.09%	1.01%	2.01%	1.72%	1.22%

Crops	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	% Average of 10 Years
Cumin	0.85%	1.26%	0.96%	1.20%	0.60%	2.59%	2.84%	2.68%	2.46%	2.89%	1.84%
Taramira	0.63%	0.22%	0.57%	0.57%	6.48%	0.34%	0.63%	1.62%	0.23%	0.09%	1.17%

(Source: Agriculture department, Nagaur)

Table 27: Cropping Pattern (%) for 10 Years (2006-07 to 2015-16) in Nagaur District

Crops	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	% Average of 10 Years
Kharif											
Green Gram	16.71%	21.47%	19.53%	22.02%	21.54%	25.41%	15.11%	23.50%	18.02%	30.12%	4.50%
Pearl Millet	36.44%	37.62%	38.96%	38.04%	38.95%	37.42%	29.68%	32.67%	29.50%	27.86%	34.75%
Sorghum	4.24%	3.06%	3.27%	4.35%	3.35%	3.13%	8.32%	4.18%	7.71%	3.69%	4.50%
Sesamum	0.86%	0.83%	2.22%	1.52%	1.75%	2.57%	1.21%	1.02%	1.29%	0.88%	1.42%
Rabi											
Wheat	6.03%	6.27%	5.31%	6.25%	5.82%	4.45%	6.97%	5.84%	5.65%	4.76%	5.73%
Barley	0.94%	1.11%	1.04%	0.95%	1.27%	0.88%	1.14%	1.04%	0.93%	0.74%	1.00%
Gram	1.38%	1.69%	1.93%	1.22%	4.29%	0.88%	3.87%	8.28%	1.81%	0.64%	2.61%
Isabgol	2.50%	1.82%	3.01%	4.09%	3.03%	2.69%	2.14%	2.25%	4.74%	3.16%	2.94%
Mustard	7.78%	7.00%	6.45%	3.77%	3.98%	2.31%	5.72%	6.59%	3.89%	4.62%	5.21%
Taramira	0.45%	0.07%	0.72%	0.05%	23.31%	0.09%	4.42%	11.78%	0.77%	0.07%	4.29%
Cumin	0.98%	1.08%	0.85%	1.30%	2.50%	4.36%	3.87%	3.76%	4.09%	3.92%	2.67%

(Source: Agriculture department, Nagaur)

Table 28: Area (in ha), Production (in MT) and Productivity (in kg/ha) in the year 2006-07 & 2015-16, Increase (+)/decrease (-) area, Production & Productivity (from 2006-07 & 2015-16) & % area, production & difference between state & district productivity (kg/h

Crops		2006-07	2015-16	Increase area, Production & Productivity	Average of 10 Years	2006-07	2015-16	Increase (+)/decrease (-) area, Production & Productivity (from 2006-07 & 2015-16)	Average of 10 Years	% area, production & difference between state & district productivity (kg/ha) over the state average
Kharif										
Green Gram	Area	759454	1363989	604535	1001942	211791	381622	169831	270921	27.04%
	Production	271112	596850	325738	400775.8	83921	194971	111050	124073	30.96%
	Productivity	357	438	81	398.2	396	511	115	438.5	40.3
Pearl Millet	Area	4910409	4044591	-865818	4739211	461777	353028	-108749	440318	9.29%
	Production	3440400	3211656	-228744	4220252	344146	2464637	2120491	607004	14.38%
	Productivity	701	794	93	894	745	698	-47	843.4	-50.6
Sorghum	Area	662055	631170	-30885	641570.1	53787	46767	-7020	57075.4	8.90%
	Production	367816	344269	-23547	828508.1	22209	33723	11514	34546.6	4.17%
	Productivity	556	545	-11	589.2	413	721	308	652.4	63.2
Sesamum	Area	273345	366736	93391	424089	10837	11176	339	17951	4.23%
	Production	88694	115310	26616	127664.6	1808	2899	1091	4672.7	3.66%
	Productivity	324	314	-10	306.3	167	259	92	241.2	-65.1
Rabi										
Mustard	Area	3099570	2532330	-567240	2561288	98538	58569	-39969	65974.8	2.58%
	Production	3766923	3257987	-508936	3269315	116081	70739	-45342	73742.9	2.26%
	Productivity	1215	1287	72	1267.4	1178	1208	30	1135.2	-132.2
Wheat	Area	2564840	3108973	544133	2851322	76384	60279	-16105	72561.7	2.54%
	Production	7755883	10468161	2712278	8721619	165160	160235	-4925	175507	2.01%
	Productivity	3024	3367	343	3225.6	2162	2658	496	2427.3	-798.3
Gram	Area	1010754	941950	-68804	1297770	17454	8069	-9385	33125.7	2.55%
	Production	872559	840341	-32218	1022230	22170	7874	-14296	34832.9	3.41%
	Productivity	863	892	29	779	1270	976	-294	1066.5	287.5
Barley	Area	232271	256029	23758	281434.6	11918	9333	-2585	12726.5	4.52%

Crops		2006-07	2015-16	Increase area, Production & Productivity	Average of 10 Years	2006-07	2015-16	Increase (+)/decrease (-) area, Production & Productivity (from 2006-07 & 2015-16)	Average of 10 Years	% area, production & difference between state & district productivity (kg/ha) over the state average
	Production	591582	766379	174797	798120.9	29937	22808	-7129	30124.8	3.77%
	Productivity	2547	2993	446	2818.7	2512	2444	-68	2373.3	-445.4
Isabgol	Area	158035	304430	146395	215409.3	31628	40046	8418	37280.4	17.31%
	Production	42929	144177	101248	98334.3	12095	28746	16651	24218.8	24.63%
	Productivity	272	474	202	467.4	382	718	336	665.4	198
	Area	149816	511078	361262	324727.6	12424	49645	37221	33846.8	10.42%
Cumin	Production	23666	200848	177182	123788.6	1713	31107	29394	15474.8	12.50%
	Productivity	158	393	235	334.7	138	627	489	435.3	100.6
Taramira	Area	112107	16792	-95315	206125	5708	841	-4867	54326.9	26.36%
	Production	38691	7279	-31412	86583.6	3266	533	-2733	25810.2	29.81%
	Productivity	345	433	88	412.3	572	634	62	567.4	155.1

(Source: Agriculture department, Nagaur)

Table 29: Total & average Area (in ha), Production (in MT) and Productivity (in kg/ha) from the year 2006-07 to 2015-16 at State level

Crops	Details	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Increase area, Production & Productivity	Average of 10 Years
Kharif													
Green Gram	Area	759454	1059587	886019	922885	1049490	1272228	791851	1019970	893947	1363989	604535	641570.1
	Production	271112	416538	373364	43981	652228	647177	234749	311199	460560	596850	325738	828508.1
	Productivity	357	393	421	48	621	509	296	384	515	438	81	589.2
Sorghum	Area	662055	625646	576744	718457	726916	553754	680375	579615	660969	631170	-30885	641570.1
	Production	367816	394746	333003	104192	508877	410114	420392	356672	5045000	344269	-23547	828508.1
	Productivity	556	631	577	145	700	741	618	616	763	545	-11	589.2

Crops	Details	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Increase area, Production & Productivity	Average of 10 Years
Pearl Millet	Area	4910409	5077396	5206162	5168502	5519448	4986783	3988912	4412998	4076909	4044591	-865818	4739211
	Production	3440400	4223266	4294938	2034875	6117800	6434880	3870673	4117910	4456123	3211656	-228744	4220252
	Productivity	701	832	825	394	1108	1290	970	933	1093	794	93	894
Rabi													
Wheat	Area	2564840	2591804	2294848	2394215	3036141	2935341	3063202	3205604	3318248	3108973	544133	2851322
	Production	7755883	7124921	7287016	2384808	10424350	10160427	10766607	11020139	9823876	10468161	2712278	8721619
	Productivity	3024	2749	3175	3133	3433	3461	3515	3438	2961	3367	343	3225.6
Barley	Area	232271	249189	286950	223406	327991	278016	307911	309281	343302	256029	23758	281434.6
	Production	591582	539049	878382	619766	934651	789153	957824	942032	962391	766379	174797	798120.9
	Productivity	2547	2163	3061	2774	2850	2839	3111	3046	2803	2993	446	2818.7
Gram	Area	1010754	1231273	1259428	884358	1783281	1433928	1252908	1923501	1256323	941950	-68804	1297770
	Production	872559	574157	981135	534630	1600718	989986	1277303	1640387	911085	840341	-32218	1022230
	Productivity	863	466	779	605	898	690	1019	853	725	892	29	779
Isabgol	Area	158035	136275	160544	227705	214974	221740	190229	184566	355595	304430	146395	215409.3
	Production	42929	49130	45813	139998	113760	120105	99903	109941	117587	144177	101248	98334.3
	Productivity	272	361	429	615	529	542	525	596	331	474	202	467.4
Sesamum	Area	273345	314871	521210	598306	548011	512765	415128	360613	329905	366736	93391	424089
	Production	88694	126861	152461	97234	223431	166335	122067	72050	112203	115310	26616	127664.6
	Productivity	324	403	293	163	408	324	294	200	340	314	-10	306.3
Mustard	Area	3099570	2458197	2738014	2212339	2489906	2441254	2424956	2782539	2433778	2532330	-567240	2561288
	Production	3766923	2196676	3465942	2912294	3883300	2950312	3759937	3620846	2878935	3257987	-508936	3269315
	Productivity	1215	957	1266	1316	1560	1209	1380	1301	1183	1287	72	1267.4
Taramira	Area	112107	38109	100120	97542	1188738	60994	109785	296459	40604	16792	-95315	206125
	Production	38691	10327	13586	35910	486366	25979	54634	176292	16772	7279	-31412	86583.6
	Productivity	345	271	365	368	409	426	498	595	413	433	88	412.3

Crops	Details	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Increase area, Production & Productivity	Average of 10 Years
Cumin	Area	149816	215474	169142	203855	110637	467977	495691	488823	434783	511078	361262	324727.6
	Production	23666	66359	42728	80531	114925	177835	176347	233819	120828	200848	177182	123788.6
	Productivity	158	308	253	395	348	380	356	478	278	393	235	334.7

(Source: Agriculture department, Nagaur)

Table 30: Total & average Area (in ha), Production (in MT) and Productivity (in kg/ha) from the year 2006-07 to 2015-16, in Nagaur district

Crops	Details	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Increase area, Production & Productivity (from 2006-07 & 2015-16)	Average of 10 Years
Kharif													
Green Gram	Area	211791	272548	246687	272043	286299	324375	181723	303816	228309	381622	169831	57075.4
	Production	83921	140788	130487	16650	192276	224193	15039	126037	116366	194971	111050	34546.6
	Productivity	396	517	529	61	672	691	83	415	510	511	115	652.4
Sorghum	Area	53787	38815	41250	53770	44560	39984	100084	54079	97658	46767	-7020	57075.4
	Production	22209	32399	34202	3939	46493	41750	17675	27948	85128	33723	11514	34546.6
	Productivity	413	835	829	73	1043	1044	177	517	872	721	308	652.4
Pearl Millet	Area	461777	477644	492278	469992	517838	477577	356983	422337	373728	353028	-108749	440318
	Production	344146	421348	488584	164891	744634	634934	105236	361928	339703	2464637	2120491	607004
	Productivity	745	882	992	351	1438	1267	295	857	909	698	-47	843.4
Rabi													
Wheat	Area	76384	79567	67100	77165	77362	56807	83768	75548	71637	60279	-16105	72561.7
	Production	165160	161304	173274	194171	194987	142525	212344	189555	161510	160235	-4925	175507
	Productivity	2162	2027	2582	2516	2520	2509	2535	2509	2255	2658	496	2427.3

Crops	Details	2006-07	2007-08	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	Increase area, Production & Productivity (from 2006-07 & 2015-16)	Average of 10 Years
Barley	Area	11918	14106	13134	11726	16898	11229	13660	13484	11777	9333	-2585	12726.5
	Production	29937	19055	32164	30962	44349	27619	33086	34640	26628	22808	-7129	30124.8
	Productivity	2512	1351	2449	2640	2625	2460	2422	2569	2261	2444	-68	2373.3
Gram	Area	17454	21493	24359	15128	56970	11200	46517	107082	22985	8069	-9385	33125.7
	Production	22170	14980	41437	19490	68076	10927	45840	102525	15010	7874	-14296	34832.9
	Productivity	1270	664	1701	1288	1195	976	985	957	653	976	-294	1066.5
Isabgol	Area	31628	23117	37990	50558	40283	34292	25725	29054	60111	40046	8418	37280.4
	Production	12095	14240	30306	44973	23791	30193	19167	21965	16712	28746	16651	24218.8
	Productivity	382	616	798	890	591	880	745	756	278	718	336	665.4
Sesamum	Area	10837	10522	28072	18811	23223	32829	14530	13127	16383	11176	339	17951
	Production	1808	3771	8579	321	9001	12428	651	3284	3985	2899	1091	4672.7
	Productivity	167	358	306	17	388	379	45	250	243	259	92	241.2
Mustard	Area	98538	88879	81540	46544	52924	29496	68825	85179	49254	58569	-39969	65974.8
	Production	116081	68788	94544	57654	71626	34667	83928	91529	47873	70739	-45342	73742.9
	Productivity	1178	774	1159	1239	1353	1175	1219	1075	972	1208	30	1135.2
Taramira	Area	5708	837	9109	617	309889	1112	53161	152232	9763	841	-4867	54326.9
	Production	3266	566	4781	480	131719	726	25036	87417	3578	533	-2733	25810.2
	Productivity	572	676	525	778	425	653	471	574	366	634	62	567.4
Cumin	Area	12424	13692	10691	16037	33281	55654	46590	48665	51789	49645	37221	33846.8
	Production	1713	4390	4836	1176	15153	29176	25097	30474	11626	31107	29394	15474.8
	Productivity	138	321	452	447	455	524	539	626	224	627	489	435.3

(Source: Agriculture department, Nagaur)

Annexure 2.3 Farmers' category wise Cultivated Area in Ladnun Cluster

Table 31. Farmers' Category wise Cultivated Area in Ladnun Cluster

Category of Farmer	Total Households	Cultivated Area (ha)			Category wise Cultivated Area (ha)			
		Irrigated	Rainfed	Total	General	SC	ST	OBC
Large farmer	1377	1377	2399.43	6994.32	9393.75	3095.28	1408.4	0
Small farmer	1122	1122	742.21	1299.21	2041.42	721.26	662.03	1.9
Marginal farmer	1006	1006	441.23	558.21	999.44	274.25	439.98	0
Landless person	783	783	0	0	0	0	0	0
No. of BPL households	678	678	0	0	0	0	0	0
Total	4288	4288	3582.87	8851.74	12434.61	4090.79	2510.41	1.9
Category wise Cultivated Area in Ladnun Cluster in %								
Large farmer	32.11%	19.30%	56.25%	75.55%	24.89%	11.33%	0.00%	41.16%
Small farmer	26.17%	5.97%	10.45%	16.42%	5.80%	5.32%	0.02%	6.89%
Marginal farmer	23.46%	3.55%	4.49%	8.04%	2.21%	3.54%	0.00%	2.29%
Landless person	18.26%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
No. of BPL households	15.81%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
Total	100.00%	28.81%	71.19%	100.00%	32.90%	20.19%	0.02%	50.34%

(Source: Watershed DPR of Ladnun Cluster)

Annexure 2.4 Status of Cropped area of Agricultural Crops in Ladnun cluster

The cropped area has been compiled from the data collected while Participatory Rural Appraisal (PRA) which was performed by the NGO during the year 2016-17.

Table 32. The Status of Cropped area of Agricultural Crops in Ladnun cluster

Season/Crop	Area (ha)	Cropping intensity/pattern (%)
Kharif		
Pearl Millet	3632.00	29.21%
Sorghum	497.00	4.00%
Green Gram	2098.02	16.87%
Moth Bean	785.00	6.31%
Cow Pea	791.01	6.36%
Cluster Bean	793.00	6.38%
Sesamum	482.00	3.88%
Groundnut	342.00	2.75%
Total	9420.03	75.76%
Rabi		
Wheat	735.00	5.91%
Barley	177.00	1.42%
Gram	97.00	0.78%
Mustard	425.00	3.42%
Taramira	24.00	0.19%
Fenugreek	211.00	1.70%
Cumin	60.00	0.48%
Isabgol	1190.00	9.57%
Total	2919.00	23.47%
Grand Total (K+R)	12339.03	99.23%
Vegetable		
Onion	5	0.04%
Pea	5	0.04%
Okra	5	0.04%
Tomato	3	0.02%
Total	18	

Season/Crop	Area (ha)	Cropping intensity/pattern (%)
Fruits		
Pomegranate	4	0.03%
Lemon	3	0.02%
Ber	7	0.06%
Total Fruits	14.00	0.37%
Total Horticulture fruits	32.00	0.26%
Grand Total	12371.03	99.49%

(Source: Agriculture department, Ladnun & Watershed DPR, Ladnun)

Annexure 2.5 Change in Area and Cropping Pattern of horticultural crops over 5 years in Rajasthan

Table 33: Cropping Pattern (%) of Horticultural Crops in 2011-12 & 2015-16 in State & Nagaur district

Crops	State					
	2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years
Pomegranate	0.005%	0.005%	0.007%	0.012%	0.014%	0.009%
Ber	0.005%	0.005%	0.005%	0.005%	0.004%	0.005%
Lemon	0.015%	0.015%	0.016%	0.017%	0.016%	0.016%
Onion	0.356%	0.274%	0.319%	0.347%	0.488%	0.357%
Pea	0.069%	0.061%	0.074%	0.077%	0.080%	0.073%
Okra	0.021%	0.023%	0.022%	0.020%	0.019%	0.021%
Tomato	0.098%	0.089%	0.094%	0.093%	0.116%	0.098%

Fenugreek	0.457%	0.375%	0.303%	0.462%	0.888%	0.496%
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(Source: Horticulture department, Jaipur)

Annexure 2.6 Change in Area and Cropping Pattern of horticultural crops over 5 years in Ladnun cluster

Table 34: Cropping Pattern (in ha & %) of Horticultural crops in Ladnun Cluster

Crops	Area (ha)	Cropping Intensity (%)
Vegetable		
Onion	5	0.04%
Pea	5	0.04%
Okra	5	0.04%
Tomato	3	0.02%
Total	18	
Fruits		
Pomegranate	4	0.03%
Lemon	3	0.02%
Ber	7	0.06%
Total Fruits	14.00	0.37%
Total Horticulture fruits	32.00	0.26%

(Source: Horticulture department, Ladnun)

Table 35: Area (in ha %) of Horticultural Crops in 2011-12 & 2015-16 & increase / decrease over 10 years in State & Ladnun cluster

Crops	State							Ladnun (Nagaur)							
	2011-12		2015-16		Increase (+)/Decrease (-) over 2011-12		Average of 5 Years	2011-12		2015-16		Increase (+)/Decrease (-) over 2011-12		Average of 5 Years	% area over state average
	Area	%	Area	%	Area	%		Area	%	Area	%	Area	%		
Pomegranate	875	0.005%	2465	0.014%	1590	0.009%	1526.00	15	0.001%	18	0.001%	3	0.000%	17.40	1.14%
Ber	968	0.005%	714	0.004%	-254	-0.001%	854.40	28	0.002%	38	0.003%	10	0.001%	30.40	3.56%
Lemon	2701	0.015%	2891	0.016%	190	0.001%	2841.00	30	0.002%	35	0.003%	5	0.000%	29.40	1.03%
Onion	64171	0.356%	86306	0.488%	22135	0.132%	63596.20	8954	0.701%	15817	1.248%	6863	0.547%	9988.60	15.71%
Pea	12516	0.069%	14219	0.080%	1703	0.011%	12927.40	1207	0.095%	1270	0.100%	63	0.006%	1075.60	8.32%
Okra	3743	0.021%	3282	0.019%	-461	-0.002%	3695.24	26	0.002%	8	0.001%	-18	-0.001%	23.40	0.63%
Tomato	17646	0.098%	20507	0.116%	2861	0.018%	17465.56	71	0.006%	50	0.004%	-21	-0.002%	62.60	0.36%
Fenugreek	82350	0.457%	157004	0.888%	74654	0.431%	88388.60	4456	0.349%	10659	0.841%	6203	0.492%	6197.80	7.01%

(Source: Horticulture department, Jaipur)

Table 36: Cropping Pattern (%) of Horticultural Crops in 2011-12 & 2015-16 in State & Nagaur district

Crops	State						Ladnun (Nagaur)					
	2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years	2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years
Pomegranate	0.005%	0.005%	0.007%	0.012%	0.014%	0.009%	0.001%	0.001%	0.001%	0.001%	0.001%	0.001%
Ber	0.005%	0.005%	0.005%	0.005%	0.004%	0.005%	0.002%	0.002%	0.002%	0.003%	0.003%	0.002%
Lemon	0.015%	0.015%	0.016%	0.017%	0.016%	0.016%	0.002%	0.002%	0.003%	0.002%	0.003%	0.002%
Onion	0.356%	0.274%	0.319%	0.347%	0.488%	0.357%	0.701%	0.649%	0.627%	0.731%	1.248%	0.792%
Pea	0.069%	0.061%	0.074%	0.077%	0.080%	0.073%	0.095%	0.011%	0.107%	0.109%	0.100%	0.085%
Okra	0.021%	0.023%	0.022%	0.020%	0.019%	0.021%	0.002%	0.004%	0.001%	0.002%	0.001%	0.002%
Tomato	0.098%	0.089%	0.094%	0.093%	0.116%	0.098%	0.006%	0.006%	0.005%	0.005%	0.004%	0.005%
Fenugreek	0.457%	0.375%	0.303%	0.462%	0.888%	0.496%	0.349%	0.302%	0.285%	0.676%	0.841%	0.491%

(Source: Horticulture department, Jaipur)

Table 37: Area (in ha), Production (in MT) and Productivity (in kg/ha) for 5 years (2011-12 & 2015-16) in state as well as Nagaur district

Crops	Details	State						Ladnun (Nagaur)					
		2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years	2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years
Pomegranate	Area	875	902	1323	2065	2465	1526.00	15	17	19	18	18	17.40
	Production	6252	5558	9812	7844	10050	7903.20	33	105	41	39	394	122.40
	Productivity	7145	6162	7416	3799	4077	5719.81	2200	6176	2158	2167	21889	6917.98
Ber	Area	968	876	857	857	714	854.40	28	23	25	38	38	30.40
	Production	6262	7406	6867	7003	6732	6854.00	193	195	201	222	2216	605.40
	Productivity	6469	8454	8013	8172	9426	8106.74	6893	8478	8040	5842	58316	17513.80
Lemon	Area	2701	2683	2929	3001	2891	2841.00	30	25	35	22	35	29.40

Crops	Details	State						Ladnun (Nagaur)					
		2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years	2011-12	2012-13	2013-14	2014-15	2015-16	Average of 5 Years
	Production	14275	15315	15415	21221	16363	16517.80	99	143	180	95	180	139.40
	Productivity	5285	5708	5263	7071	5659	5797.29	3300	5720	5143	4318	5143	4724.78
Onion	Area	64171	47920	58221	61363	86306	63596.20	8954	7801	8105	9266	15817	9988.60
	Production	604094	481631	698505	960784	1435112	836025.20	68922	60047	109654	191892	246268	135356.60
	Productivity	9414	10051	11997	15657	16628	12749.48	7697	7697	13529	20709	15570	13040.59
Pea	Area	12516	10740	13600	13562	14219	12927.40	1207	131	1385	1385	1270	1075.60
	Production	22581	21702	22871	30359	31280	25758.60	2239	138	2136	2136	2768	1883.40
	Productivity	1804	2021	1682	2239	2200	1989.01	1855	1053	1542	1542	2180	1634.49
Okra	Area	3743	4017	3953	3481	3282	3695.24	26	45	14	24	8	23.40
	Production	12276	12882	12265	11819	10340	11916.40	44	76	13	33	16	36.40
	Productivity	3280	3207	3103	3395	3151	3227.08	1692	1689	929	1375	2000	1536.95
Tomato	Area	17646	15505	17151	16519	20507	17465.56	71	70	61	61	50	62.60
	Production	67967	73567	81753	75228	83286	76360.16	146	123	61	134	210	134.80
	Productivity	3852	4745	4767	4554	4061	4395.63	2056	1757	1000	2197	4200	2242.04
Fenugreek	Area	82350	65514	55376	81699	157004	88388.60	4456	3632	3679	8563	10659	6197.80
	Production	87382	71528	64102	84186	190362	99512.00	4728	3517	3575	7122	10450	5878.40
	Productivity	1061	1092	1158	1030	1212	1110.58	1061	968	972	832	980	962.64

(Source: Horticulture department, Jaipur)

Annexure 2.7 Average Annual Rainfall in last decade in Ladnun cluster

Table 38: Average Annual Rainfall in the last 10 years (decade) in Ladnun cluster

S. No	Year	Average Annual Rainfall (mm)
1	2006	352
2	2007	235
3	2008	358
4	2009	221
5	2010	488
6	2011	480
7	2012	568
8	2013	472
9	2014	496
10	2015	456
	Total	4126
	Average	412.6
	Say	413

(Source: Water Resource department, Nagaur)

Annexure 2.8: Approach to study ground water occurrence

To study about ground water occurrence & its movement, the various litho units have been classified on the basis of their degree of consolidation and related parameters. The Aquifer in the Cluster area is Sandstone. The presence of bedding planes, joints, contact zones and fractures controls the ground water occurrence, movement and yield potential. The availability, occurrence and movement of ground water depend upon the topography, structures, geomorphology and hydrological properties of the water bearing materials. Ground water occurs under unconfined to semi-confined conditions.

In GEC'97, two approaches have been recommended. The water level fluctuation method is based on the concept of storage change due to difference between various input and output components. Input refers to recharge from rainfall and other sources and subsurface inflow into the assessment unit. Output refers to ground water draft, ground water evapotranspiration and base flow to streams and subsurface outflow from the Aquifer. Since the data on subsurface inflow/ outflow are not readily available, therefore the inflow/ outflow across these boundaries may be taken as negligible. In each assessment unit, hilly areas having slope more than 20% are deleted from the total area to get the area suitable for recharge.

Further, areas where the quality of ground water is beyond the usable limits should be identified and handled separately. The remaining area, after deleting the hilly area and separating the area with poor ground water quality, has been delineated into command and non-command areas. Ground water assessment in Ladnun Cluster is done on non-command areas for monsoon and non-monsoon seasons and consolidated as Net Annual Ground water Availability in the Cluster area.

Ground water potential of Ladnun cluster area block Ladnun, Nagaur district has been estimated as on 31.03.2013 on the basis of GEC-97 Guidelines. Net Annual Ground water Availability as on 31.03.2013 was 4.23 MCM. The details are given in **Annexure 2.14**.

Annexure 2.9 SRR in Nagaur district & Rajasthan

Table 39: Seed Replacement Rate (SRR) in Rajasthan and District

Crop	Rajasthan						District-Ladnun (Nagaur)					
	2013-14			2014-15			2013-14			2014-15		
	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)
Kharif												
Sorghum	5.79	12715	21.95	6.61	10876	16.45	0.54	0	0	0.98	9	0.09
Pearl Millet	44.13	105614	59.83	40.76	94439	57.92	4.22	5001	29.63	3.74	668	44.57
Sesamum	3.6	2188	20.23	3.3	2997	30.27	0.13	68	17.3	0.16	344	71.67
Greengram	10.2	48526	23.79	8.94	39430	22.05	3.04	3683	6.06	2.28	2763	6.1
Moth Bean	9.28	13129	9.43	8.69	10365	7.95	1.5	891	3.96	1.33	1209	6.06
Cow Pea	0.61	5848	47.65	0.6	1983	16.43	0.11	32	1.45	0.09	0	0
Groundnut	4.62	28041	4.05	5.01	65348	8.7	0.13	304	1.56	0.14	220	1.05
Rabi												
Wheat	32.05	1022634	31.9	33.18	1082866	32.63	0.75	14486	19.17	0.72	25872	36.12

Crop	Rajasthan						District-Ladnun (Nagaur)					
	2013-14			2014-15			2013-14			2014-15		
	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)	Area (lac ha)	Seed Dist. (Qtl)	SRR (%)
Barley	3.09	115195	37.25	3.43	132971	38.73	0.13	2089	15.49	0.12	2070	17.58
Gram	19.23	170104	11.79	12.56	171839	18.24	1.07	4354	5.42	0.23	3477	20.17
Mustard	27.81	90171	81.02	24.33	87925	90.32	0.85	2705	79.39	0.49	1610	81.72

(Source: Agriculture Department, Ladnun)

Annexure 2.10 SRR in Ladnun cluster

S. No.	Crop	Name of certified/Improved varieties being shown in the cluster	2011-12	2012-13	2014-15	2015-16
1	Wheat	Raj-4079,4120,3765,3077 etc.	76	78	80	85.93
2	Mustard	RGN-48,NRc-HB-101	87	89	90	92.87
3	Isabgol	GI-1,2	9	10	10	10.7
4	Pearl millet	RHB-67,173,177	87	88	88	91.93
5	Moong	IPM-0203,SML-668, RMG-492	36	40	42	45.31
6	Moth	RMO-257,RMO-423	25	27	28	30.28

(Source: Agriculture Department, Nagaur)

Annexure 2.11 Area Covered and Technical Grade Material used under Plant Protection Measures during 2014-15 in Rajasthan & Nagaur

Table 40. The Area (in 000ha) Covered and Technical Grade Material (TGM) used under Plant Protection Measures during 2014-15 in Rajasthan and Nagaur (Method of Plant Protection)

State/District	Season	Cereals	Pulses	Food Grains	Oilseed	Sugarcane	Cotton	Guar	Others
Rajasthan	K	4049	1277	5326	1856	16	775	1242	445
	R	2862	1160	4022	2289	0	0	0	690
	K&R	6911	2437	9348	4145	16	775	1242	1135
Nagaur	K	227	102	329	19	0	12	31	10
	R	108	28	136	102	0	0	0	9
	K&R	335	130	465	121	0	12	31	19
Rajasthan (%)	K	26.34%	8.31%	34.65%	12.08%	-	5.04%	8.08%	2.90%
	R	30.75%	12.46%	43.21%	24.59%	-	0.00%	0.00%	7.41%
	K&R	28.00%	9.88%	37.88%	16.80%	-	5.04%	8.08%	4.60%
Nagaur (%)	K	19.36%	8.70%	28.05%	1.62%	-	1.02%	2.64%	0.85%
	R	32.65%	8.46%	41.11%	30.84%	-	0.00%	0.00%	2.72%
	K&R	22.28%	8.65%	30.93%	8.05%	-	1.02%	2.64%	1.26%

(K – Kharif, R – Rabi & T – Total)

(Source: Agriculture Department, Ladnun)

Annexure 2.12 Area Covered and Technical Grade Material used under Plant Protection Measures during 2014-15 in Ladnun cluster

Table 41 Area Covered and Technical Grade Material (TGM) used under Plant Protection Measures during 2014-15 (Method of Plant Protection)

State/District	Season	Seed Treat	Soil Treat	Poly Treat	Intensive Treat	Rat Control	Weed Control	Total Area	TGM in tones
Rajasthan	K	6940	349	700	1178	138	355	9660	719
	R	4503	329	518	848	278	525	7001	1975
	K&R	11443	678	1218	2026	416	880	16661	2694
District	K	301	19	25	31	9	16	401	17
	R	165	12	13	28	16	13	247	48
	K&R	466	31	38	59	25	29	648	65
Rajasthan (%)	K	45.15 %	2.27 %	4.55 %	7.66%	0.90%	2.31%	62.85 %	4.68%
	R	48.38 %	3.53 %	5.57 %	9.11%	2.99%	5.64%	75.21 %	21.22 %
	K&R	46.37 %	2.75 %	4.94 %	8.21%	1.69%	3.57%	67.51 %	10.92 %
District (%)	K	25.67 %	1.62 %	2.13 %	2.64%	0.77%	1.36%	34.19 %	1.45%
	R	49.88 %	3.63 %	3.93 %	8.46%	4.84%	3.93%	74.67 %	14.51 %
	K&R	30.99 %	2.06 %	2.53 %	3.92%	1.66%	1.93%	43.10 %	4.32%

(K – Kharif, R – Rabi & T – Total)

(Source: Agriculture Department, Ladnun)

Annexure 2.13 Crop Water Requirement of Agricultural and Horticultural Crops in Ladnun

Table 42. Crop Water Requirement of Agricultural and Horticultural Crops in Project area

Name of crop	Present crop Area in ha	Crop water Cum /ha	Present Crop Water requirement in cum	Proposed Cropped area (ha)	Proposed Crop Water requirement in cum	Present Crop Water requirement in cum being drafted from GW	Additional Crop Water Requirement in Cum
Kharif							
Pearl Millet	3632.00	1000	3632000	4358.40	4358400	3632000	726400
Sorghum	497.00	1000	497000	497.00	497000	497000	0
Greengram	2098.02	1000	2098020	2307.82	2307822	2098020	209802
Moth Bean	785.00	1000	785000	785.00	785000	785000	0
Cow Pea	791.01	1000	791010	553.71	553707	791010	-237303
Cluster Bean	793.00	1000	793000	785.07	785070	793000	-7930
Sesamum	482.00	1000	482000	385.60	385600	482000	-96400
Groundnut	342.00	2000	684000	273.60	547200	684000	-136800
Total	9420.03		9762030	9946.199	10219799	9762030	457769
Rabi							
Wheat	735	4000	2940000	441.00	1764000	2940000	-1176000
Barley	177	2000	354000	159.30	318600	354000	-35400
Gram	97	2000	194000	87.30	174600	194000	-19400
Mustard	425	2500	1062500	416.53	1041325	1062500	-21175
Taramira	24	1000	24000	21.60	21600	24000	-2400
Fenugreek	211	1000	211000	187.79	187790	211000	-23210
Cumin	60	2500	150000	54.00	135000	150000	-15000
Isabgol	1190	3000	3570000	1785.00	5355000	3570000	1785000
Total	2919		8505500	3152.52	8997915	8505500	492415
Grand Total (K+R)	12339.03		18267530	13098.72	19217714	18267530	950184
Vegetable							
Onion	5	5000	25000	20.00	100000	25000	75000

Name of crop	Present crop Area in ha	Crop water Cum /ha	Present Crop Water requirement in cum	Proposed Cropped area (ha)	Proposed Crop Water requirement in cum	Present Crop Water requirement in cum being drafted from GW	Additional Crop Water Requirement in Cum
Pea	5	5000	25000	20.00	100000	25000	75000
Okra	5	8000	40000	15.00	120000	40000	80000
Tomato	3	8000	24000	8.00	64000	24000	40000
Total	18		114000	63	384000	114000	270000
Fruits							
Pomegranate	4	11000	44000	40.00	440000	44000	396000
Lemon	3	9000	27000	10.00	90000	27000	63000
Ber	7	5000	35000	15.00	75000	35000	40000
Total Fruits	14.00		106000	65.00	605000	106000	499000
Total Hort. Crops	32.00		220000	128.00	989000	220000	769000
Grand Total	12371.03		18487530	13226.72	20206714	18487530	1719184

(Source: Agriculture Department & Watershed DPR, Ladnun)

Annexure 2.14 Data to calculate ground water status of Ladnun cluster

The principal source of recharge to ground water is rainfall. Annual monsoon and non-monsoon rainfall (mm) from the year 2008 to 2012 of the Nagaur district are attached in the excel sheets with the CACP report of Ladnun

It also includes the following-

- a. Ground water level of the cluster
- b. Ground water extraction status

Annexure 2.15 Supporting institutions and service providers in Nagaur

Table 43: Supporting institutions and service providers in Nagaur

S.No	Type of assistance	Name and address of agencies
1	Identification of Project Profiles, techno-economic and managerial consultancy services, market survey and economic survey reports.	1.MSME TECHNOLOGY DEVELOPMENT CENTRE– HAND TOOLS (Ministry of Micro, Small & Medium Enterprises. Govt. Of India) Industrial Area , 2. MSME Development Institute, 3. District Industries Centre, Nagaur
2	Land and Industrial shed	Rajasthan State industrial Development and Investment Corporation Ltd. (RIICO)
3	Financial Assistance	Rajasthan Finance Corp.,Nagaur
4	For raw materials under Govt. Supply	Rajasthan Small Industries Corporation Ltd.
5	Plant and machinery under hire /purchase basis.	National Small Industries Corporation Ltd., Nehru
6	Power/ Electricity	Ajmer Vidhyut Vitaran Nigam Ltd., Nagaur
7	Technical Know –how.	MSME Development Institute,
8	Quality & Standard	1. MSME_Testing Station , Ind. Estate Bais, 2. National Test House,VKIA,Jaipur, 3. IIQM,MIA, Jaipur
9	Marketing Assistance /Export	1.National Small Industries Corporation Ltd. Nehru, 2.Rajasthan Small Industries Corporation Ltd.

Annexure 2.16 Number of Household and Household Enterprises owning Animal/Poultry Birds in Ladnun Cluster

Table 44 Number of Household and Household Enterprises owning Animal/Poultry Birds in Ladnun Cluster

S. No.	Village	Cattle	Buffaloes	Goats	Sheep	Pigs	Backyard Poultry	Poultry Farm & Hatcheries
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1	Bharnawa	94	97	1472	10	0	0	0
2	Chandrai	45	75	119	3	0	0	0
3	Hirawati	134	110	285	28	0	0	0
4	Jhardiya	51	86	120	17	0	0	0
5	Lukas	47	62	83	0	0	0	0
6	Manu	164	159	250	3	0	0	0
7	Nimbi Jodhan	354	453	1069	19	2	1	0
8	Odeet	227	270	516	21	0	0	0
9	Sunari	211	231	494	6	0	1	0
10	Toki	68	63	134	12	0	0	0
TOTAL		1395	1606	4542	119	2	2	0

(Source: Animal Husbandry department, Ladnun)

Annexure 2.17 Goat Population profile of Ladnun cluster

Table 45 Goat Population profile of Ladnun cluster

S No.	Village	Male			Female				Total Goats	
		Under 1 Year	1 Year and Above	Total	Under 1 Year	1 Year and Above				
						In Milk	Dry	Not Calved Once		
1	Bharnawa	218	2	220	201	332	212	1	746	966
2	Chandrai	27	5	32	67	199	96	0	362	394
3	Hirawati	17	21	38	234	708	460	390	1792	1830
4	Jhardiya	216	12	228	201	318	248	1	768	996
5	Lukas	3	0	3	176	170	68	96	510	513
6	Manu	83	22	105	189	418	218	0	825	930
7	Nimbi Jodhan	1196	31	1227	1071	2154	1190	406	4821	6048
8	Odeet	210	148	358	402	1089	646	685	2822	3180
9	Sunari	226	12	238	264	471	916	174	1825	2063
10	Toki	159	7	166	172	263	228	4	667	833
TOTAL		2355	260	2615	2977	6122	4282	1757	15138	17753

(Source: Animal Husbandry department, Ladnun)

Annexure 3.1 Parameters and their definition for selection of Value Chain crops

Parameters and Weightage for the selection of Value Chain reports

#	Parameters	Weightage
A.	Existing size	30
1	Cropped Area of the crop in the cluster (in acre)	10
2	Crop Production in the cluster (in quintals)	10
3	Crop Productivity (cluster level compared to national's average)	10
B.	Potential for Value addition within Rajasthan (implying scope for increased value addition for local producers and processors)	45
4	Price spread in Rs/Q (Price paid at APMC mandi- realization by farmer at farm level)	5
5	Price spread in Rs/Q (Price paid by customer at retail level realization by farmer at farm level)	5
6	Net profit in production (Rs per acre)	5
7	Scope for processing in the state	10
8	Scope for value addition (Primary/ secondary/ tertiary processing)	10
9	Growth in market demand 5 year	10
C.	Risk assessment	10
10	Price Volatility (last 5 years; due to monsoon, due to adverse agronomical conditions)	10
D.	Others (Environmental & Social Parameter)	15
11	Water requirement	15
Total		100

Definition of Parameters

1. Area

It is the cropped area in acres under cultivation of the particular crop in the concerned cluster as per data available with RACP for the year 2016-17. The area parameter has been accorded weightage of 10%. Crops have been given scores from 1 to 10 based upon their area of cultivation. The crop with the largest area is accorded the highest score of 10 while the remaining crops are given proportionately lower marks.

2. Production

It is the total production of the crop in quintal in the cluster as per data available with RACP for the year 2016-17. The area parameter has been accorded weightage of 10%. Crops have been allotted scores from 1 to 10 based on their production levels. The crop with maximum production gets highest score of 10 while the remaining crops get proportionately lower marks.

3. Productivity

The productivity value of the crop is the comparison of the productivity (Q/Acre) of the crop in the cluster (as per the data available from RACP for the year 2016-17) as against average national productivity (Q/Acre) of the same crop (as per the data by Directorate of Economics and Statistics). The area parameter has been given a weightage of 10%. Cluster level productivity of the crops has been scored from 1 to 10. The crop having average productivity of the cluster greater than or equal to that of national average will get 10 whereas the crop having average productivity of the cluster less than that of national average will get proportionately/ relatively less score. For eg. Crop having cluster average productivity of 5 Q/acre and national average of 10 Q/acre will get 5 marks. Similarly if crop has cluster productivity of 3 Q/acre then it will get 3 marks. If the crop is having either 12 Q/acre or 15 Q/acre then both will get 10 marks.

4. Price spread at Mandi level

The price spread at mandi level can be defined as the difference between the value realization by farmer at the farm level (as per field consultation) by selling the raw crop produce and the price of the same crop obtained at primary processor level (as per the data available on www.agmarknet.nic.in). It is measured in Rs per quintal. The price spread at mandi level (parameter) has been accorded weightage of 5%. The crops have been scored from 1 to 5 based upon their price spread at mandi level; with the crop with higher price spread at mandi level receiving a higher score.

5. Price spread at retail level

The price spread at retail level can be defined as the difference between the value realization of farmer at the farm level (as per field consultation) by selling the raw crop produce and the price of the same crop, with highest degree of value addition, paid by consumer at the retail level (as per field consultation). It is measured in Rs per quintal. The price spread at retail level parameter has been given a weightage of 5%. The crops have been scored from 1 to 5 based upon their production, with the crop with higher price spread at retail level receiving higher score.

6. Net profit in production

It is the net income accrued to the farmer by selling the raw produce (commodity) at the farm level after deduction of the total cost of production involved (as per field consultation). It is measured in Rs. per quintal. This parameter has been accorded a weightage of 5%. The crops have been given scores from 1 to 5 based upon their net profit. The crop with the maximum net profit from production is given the highest score of 5 while the remaining in the crops area are accorded proportionately lower marks.

7. Scope for processing in the state

It is the total number of functionally active processing units of a particular commodity in the state as per the data available from DICs. This parameter has been given a weightage of 10%. Commodities have been given scores from 1 to 10 based on the total number of functional processing units. The commodity with higher number of processing units in the state gets higher score because it portrays higher availability of ready market in the vicinity of the farms which reduces the intermediary logistics costs for the producers as well ensures steady returns.

8. Scope for value addition

The number of feasible value added products of a particular commodity in the concerned cluster indicates the scope for value addition (primary, secondary and tertiary) in the respective crop. This parameter has been accorded weightage of 10%. Commodities have been given scores from 1 to 10. The commodity with higher number of value added products gets a higher score.

9. Growth in market demand

In order to capture the growth in market demand of a particular commodity, an assumption has been formulated that consumption of that commodity for the last 5 years can be equated with the

current growth in consumer level consumption of the commodity (as per data available on authentic public domain) This parameter has been given a weightage of 10% and commodities have been scored from 1 to 10 based on the basis of growth in their consumption demand. The commodity with higher growth in demand will get a higher score.

10. Price Volatility

Price volatility is per cent difference between the highest attained mandi price of a crop compared to the lowest attained mandi price during last 3/5 years (as per data available on www.agmarknet.nic.in). This parameter has been given a weightage of 10% and commodities have been scored from 1 to 10 based on the price volatility. The commodity with the higher range gets a higher score as they have greater scope for intervention in their existing value chain such that the farmer's risk gets reduced and higher returns could be ensured.

11. Water requirement

This is the water required by the crop in cubic metres per hectare at the cultivation stage in one season (as per data available from RACP for the year 2016-17). This parameter has been given a weightage of 15% and commodities have been scored from 1 to 15 based on the water requirement. The commodity with the lower water requirement gets a higher score as it could be promoted for crop diversification and efficient water use at the farm level.

Appendix 3.2 Scoring Matrix for prioritization of Value chain crops in Ladnun

The parameters as well as relative scores of commodities in the Ladnun cluster presented below:

Table 46: Parameters for prioritization of Value chain commodities in Ladnun cluster

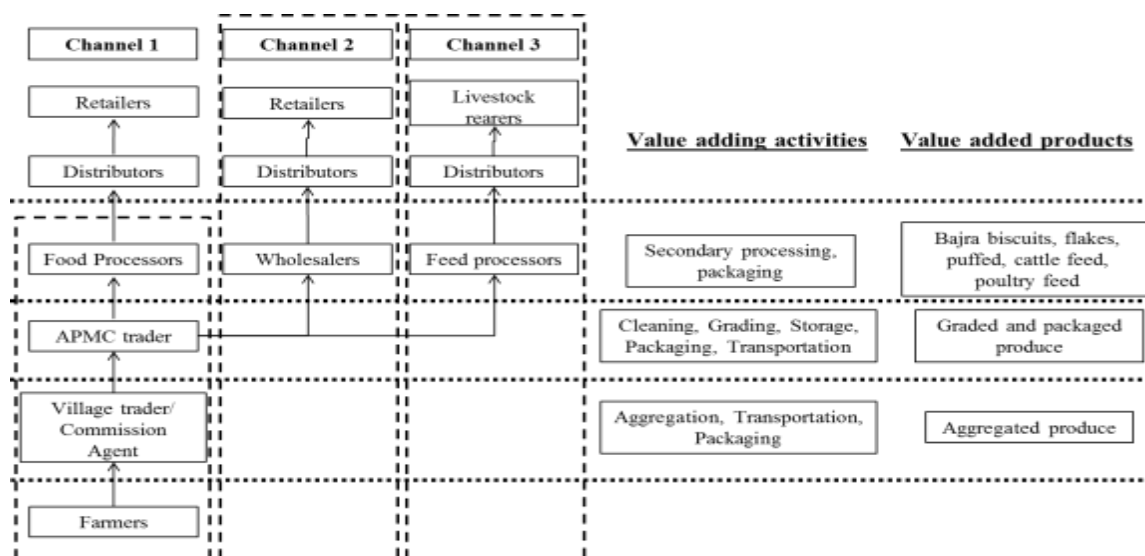
Sr. No.	Parameters	Weightage	Bajra	Green gram	Guar	Wheat	Mustard	Isabgol
A.	Existing size	30	30.0	20.6	14.4	16.6	12.3	15.7
1	Cropped Area of the crop in the cluster (in acre)	10	10.0	5.8	2.2	2.0	1.2	3.3
2	Crop Production in the cluster (in quintals)	10	10.0	4.9	2.2	4.5	1.2	2.4
3	Crop Productivity (cluster level compared to national's average)	10	10.0	10.0	10.0	10.0	10.0	10.0
B.	Potential for Value addition within Rajasthan (implying scope for increased value addition for local farmers and processors)	45	17.5	24.5	22.8	23.7	26.8	22.0
4	Price spread in Rs/ Qtl (Price paid at APMC mandi- realization by farmer at farm level)	5	0.7	2.0	1.5	0.8	1.6	5.0
5	Price spread in Rs/ Qtl (Price paid by customer at retail level- realization by farmer at farm level)	5	3.7	2.1	3.5	1.2	0.6	5.0
6	Net profit in production (Rs per acre)	5	1.6	0.5	0.9	2.2	0.9	5.0
7	Scope for processing in the state	10	4.0	6.0	2.0	5.0	10.0	2.0
8	Scope for value addition (Primary/ secondary/ tertiary processing)	10	7.5	7.5	5.0	10.0	7.5	5.0
9	Growth in market demand 5 year	10	0.0	6.3	10.0	4.5	6.3	0.0
C.	Risk assessment	10	9.2	10.0	7.7	7.6	7.9	0.0
10	Price Volatility (last 5 years; due to monsoon, due to adverse agronomical conditions)	10	9.2	10.0	7.7	7.6	7.9	0.0
D.	Others (Environmental Parameter)	15.0	15.0	15.0	15.0	0.0	7.5	5.0
11	Water requirement	15.0	15.0	15.0	15.0	0.0	7.5	5.0
Total		100.0	71.7	70.1	59.9	47.9	54.5	42.7

Source: Data analysis by ABPF- Grant Thornton

Appendix 3.3 Current marketing chain of Value chain crops in Ladnun

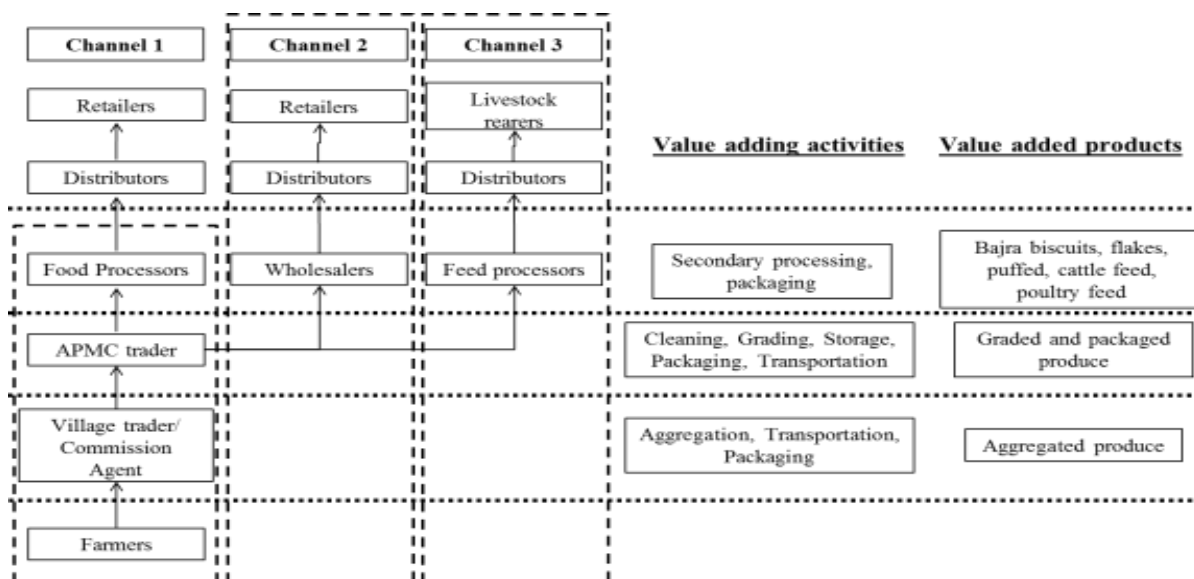
- Bajra

Figure 9: Current structure of marketing chains - Bajra



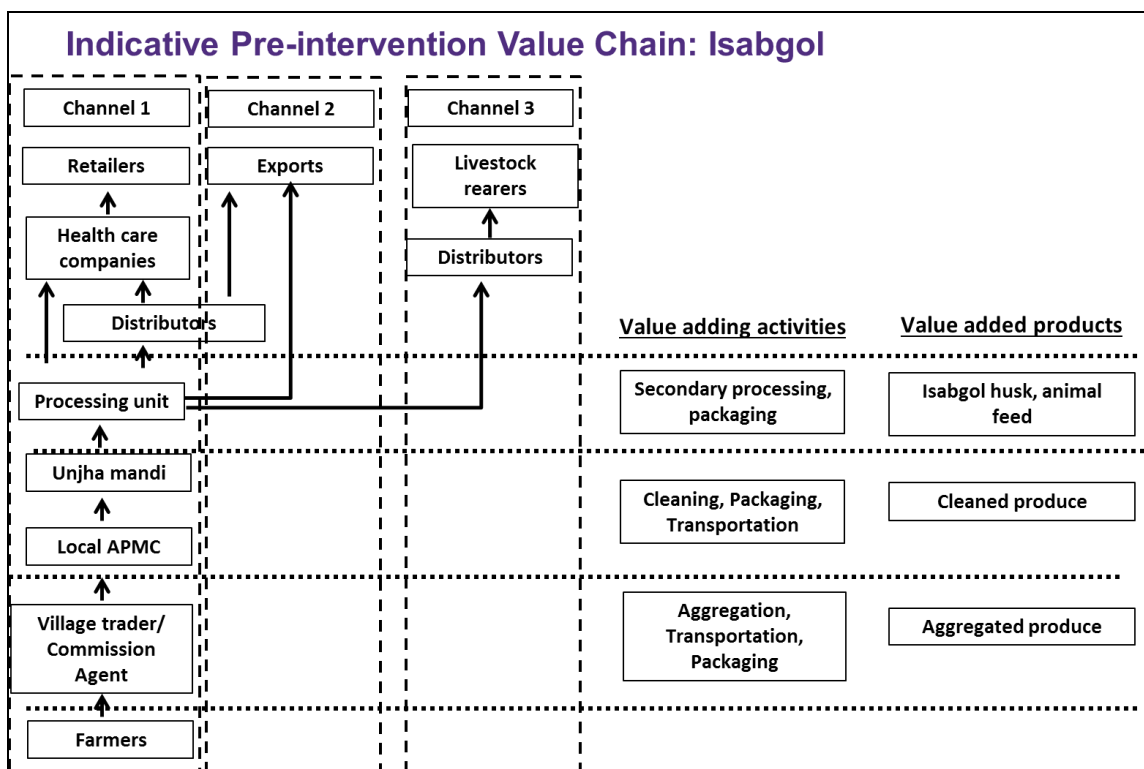
- Green gram

Figure 10: Current structure of marketing chains - Green gram



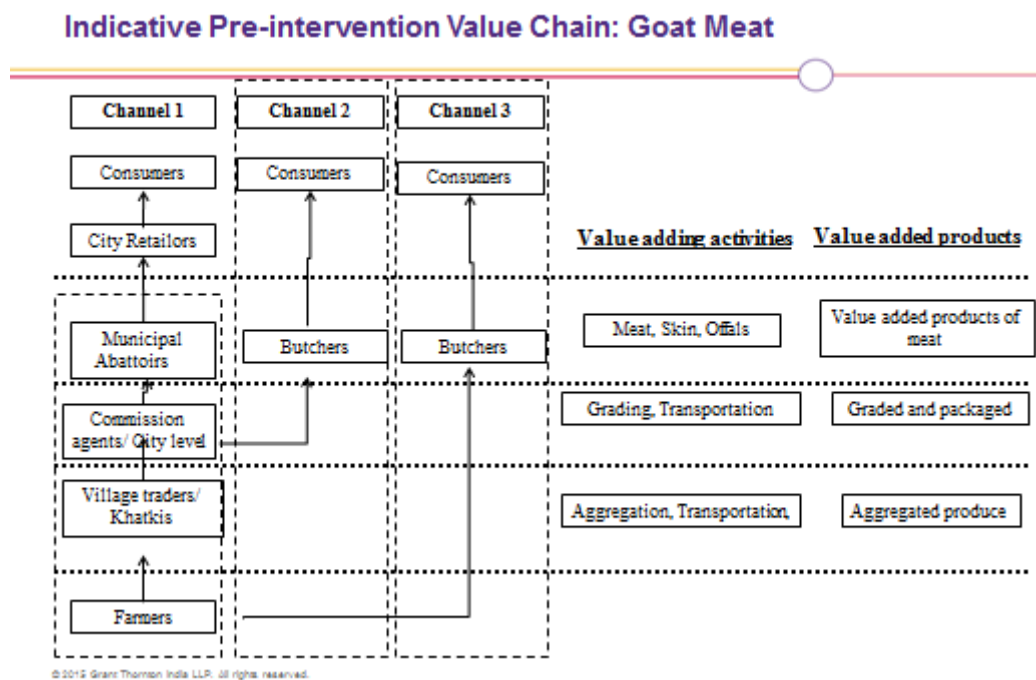
- Isabgol

Figure 11: Current structure of marketing chains of Isabgol



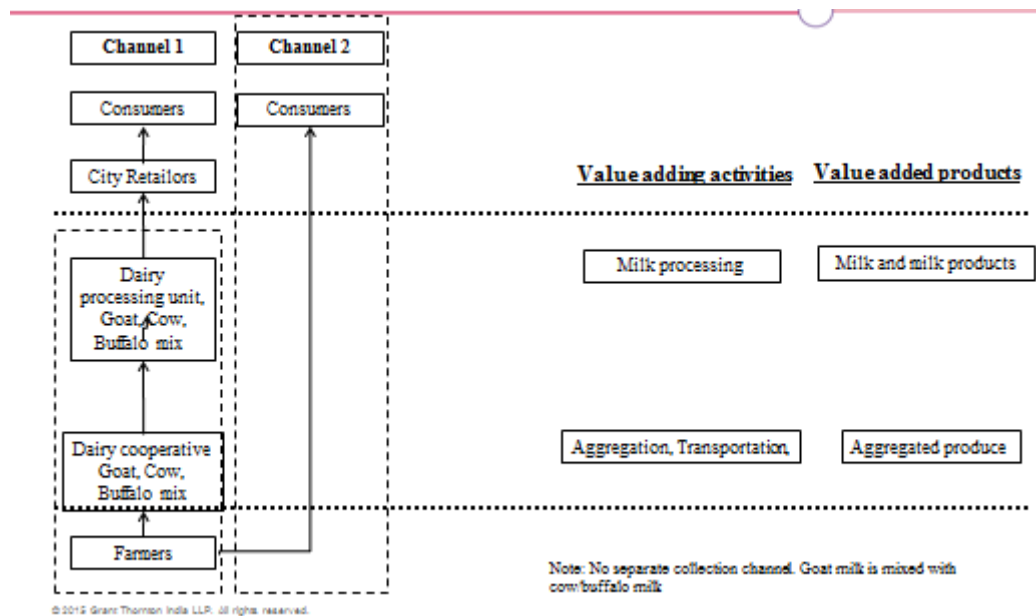
- **Goat Meat**

Figure 12: Current structure of marketing chains of Goat Meat



- **Goat Milk**

Figure 13: Current structure of marketing chains of Goat Milk



Appendix 3.4 Historical mandi/ farm gate prices (or farmer operating margins) trends of Value Chain crops

To identify the trend of the commodity, prices of 3 seasons have been gathered:

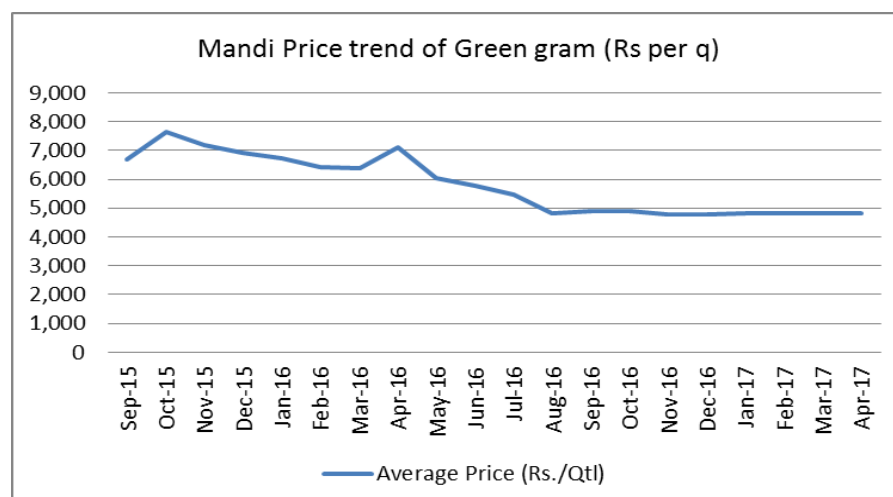
Green gram

Table 47: Price trend of Green gram in Jaisalmer mandi for 2 years

Month	Price (Rs./Qtl)	Month	Price (Rs./Qtl)
Sep-15	6,692	Jul-16	5,476
Oct-15	7,643	Aug-16	4,818
Nov-15	7,200	Sep-16	4,883
Dec-15	6,920	Oct-16	4,907
Jan-16	6,737	Nov-16	4,800
Feb-16	6,411	Dec-16	4,800
Mar-16	6,370	Jan-17	4,809
Apr-16	7,100	Feb-17	4,819
May-16	6,045	Mar-17	4,822
Jun-16	5,758	Apr-17	4,818

The trend shows that in Rajasthan, price of the commodity is varying over the period of 3 years. This is in respect to all the commodities that price dips to lowest at the harvesting time and rise to the highest during the cultivation time.

Figure 14: Price trend of Green gram in Jaisalmer mandi for 2 years



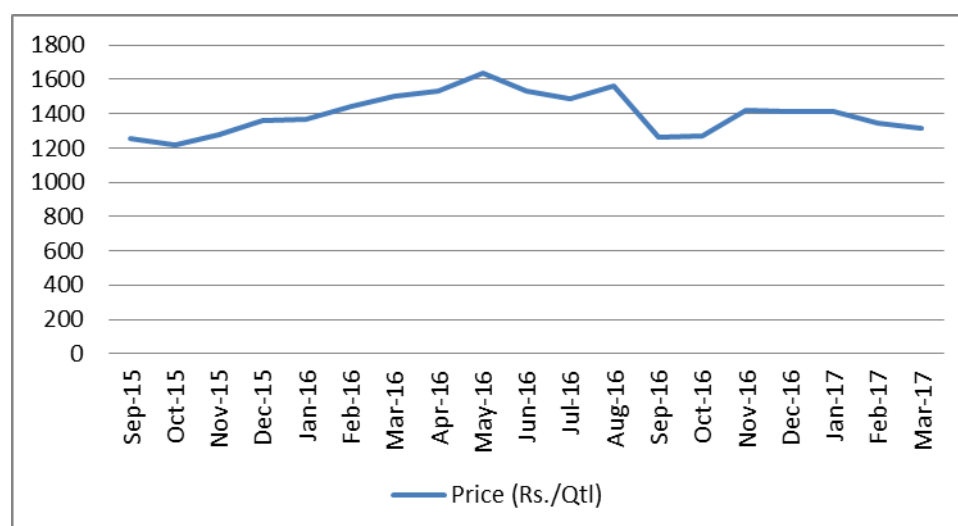
Bajra

Table 48: Price trend of Bajra in Jaisalmer mandi in last 3 years

Month	Price (Rs./Qtl)	Month	Price (Rs./Qtl)
Sep-15	1255	Jul-16	1488
Oct-15	1216	Aug-16	1561
Nov-15	1281	Sep-16	1264
Dec-15	1362	Oct-16	1270
Jan-16	1369	Nov-16	1421
Feb-16	1439	Dec-16	1409
Mar-16	1504	Jan-17	1413
Apr-16	1528	Feb-17	1343
May-16	1633	Mar-17	1316
Jun-16	1528		

The trend shows that in Rajasthan, price of the commodity is largely in the same range over the period of 3 years. This is in respect to all the commodities that price dips to lowest at the harvesting time and rise to the highest during the cultivation time.

Figure 15: Price range of Bajra in past 3 seasons



Appendix 3.5 Growth in demand of Value chain crops

Parameters as under are identified, which support in determination of future demand growth of a commodity. With the consultation of the various stakeholders of value chain, growth in upcoming 3 years for Green gram has been formulated which is shown in the table below.

With the consultation of the various stakeholders of value chain, growth in upcoming 3 years for Green gram has been formulated which is shown in the table below.

Green gram

The national consumption of Green gram in the year 2014-15 was 1,500,000 MT which has decreased at a CAGR of 6.23% for past 4 years.

National Demand Growth of Green gram ('000 MT)				
201/11	2011/12	2012/13	2013/14	2014/15
1,940	1,780	1,340	1,430	1,500

Bajra

Bajra has larger consumption in rural areas than urban. Although the demand for food Bajra has decreased by 14% CAGR in past 3 years but the demand in alternate segment (non-food) like cattle feed and malt is increasing and currently captures almost about 70% of the total consumption of Bajra.

National Demand Growth of Bajra (per capita consumption in kg)		
1999-2000	2004-2005	2009-2010
2.79	1.66	2.07

Appendix 3.6 Economic Analysis of Selected Value Chain Crops

Cost of cultivation is the prerequisite aspect in the calculation of economics of a crop. Primary researches helped in getting the whole information related to economics of a crop.

Table 49: Cost of economics of commodities

S.N.	Commodity	Cost of cultivation (Rs./acre)	Productivity (Qtl/acre)	Selling Price (Rs./Qtl)	Revenue from crop (Rs./acre)	Net surplus including fodder (Rs./acre)
1	Bajra	12,000	3.12	6,000	6,696	8,696
2	Green gram	8,500	2.50	4,000	1,500	3,500
3	Isabgol	8,000	4.08	10,000	32,800	32,800
4	Guar	5,200	2.50	2,900	2,050	3,550
5	Mustard	8,000	4.50	3,100	5,950	6,590
6	Wheat	11,000	11.50	1,600	7,400	12,200

Appendix 3.7 Livestock population and Fodder Requirement of Ladnun cluster

Table 50: Livestock population and Fodder Requirement of Ladnun cluster

S. No.	Description of animals	Population in No.	Yield (milk/mutton/Wool)	Units	Dry Matter Requirement per animal (KGPD)	Total requirement per year in M.T.
1	Cattle (Indigenous)	4167	3.093	Lit/day	7	10647
2	Cattle (CB)	48	6.386		7	123
2	Buffaloes	4538	4.856	Lit/day	7	11595
3	Goat	17753	0.50 – 1.00	Lit/day, kg/no.	1.2	7776
4	Sheep	2745	0.50 – 1.00/ 1-2	Lit/day, kg/Yr.	1.2	1202
7	Piggery	101			3.5	129
	Total Livestock	29542				31471

(Source: Animal Husbandry Department, Ladnun)

Table 51: Fodder availability in Ladnun Cluster (Qty. in MT)

Name of crop	Proposed Area (ha)	Productivity (Kg/ha)	Production (in MT)
Kharif			
Pearl Millet	4358.40	4000	17434
Sorghum	497.00	4000	1988
Greengram	2535.26	2000	5071
Moth Bean	785.00	3000	2355
Cow Pea	553.71	3000	1661
Cluster Bean	785.07	3000	2355
Sesamum	385.60	0	0
Groundnut	273.60	3000	821
Total	10173.64		31684.25
Rabi			
Wheat	441.00	4500	1985
Barley	159.30	4500	717

Name of crop	Proposed Area (ha)	Productivity (Kg/ha)	Production (in MT)
Gram	87.30	4000	349
Mustard	416.53	0	0
Taramira	21.60	0	0
Fenugreek	187.79	1000	188
Cumin	54.00	0	0
Isabgol	1785.00	0	0
Total	3152.52		3238.34
Grand Total	13326.16		34922.59

(Source: Agriculture Department, Ladnun)

Annexure-5.1: Operational and Implementation Arrangements

Operational and Implementation Arrangements

The eligible activities for investment under Agriculture subcomponent would be implemented through Agriculture Department. The Deputy Director, Agriculture (Extension) ZP of the concerned district who is also DPM, RACP is responsible for implementation of the activities.

Component 1: Climate Resilient Agriculture

On-farm Integrated Crop Management (ICM) demonstrations will be the core project intervention under this sub-component, and the main vehicle for the dissemination of improved technologies to the farmers. Demonstrations serve as an effective instrument for rapid dissemination of technology. The effectiveness of demonstrations would increase with organization of field days around the demonstrations. The demonstrations to be organized under this project would be preferably composite demonstrations, demonstrating complete technology package of production.

Adoption rate of demonstration's technologies will be recorded in the years following the year in which demonstrations are organized. The adoption rates (number of farmers adopting demonstrated technologies, area on which, the technologies are adopted and farm level yield gains achieved by the farmers) will be monitored in the following years. This is essential for evaluating the productivity/quality gains achieved by the farmers as a result of demonstrations and trainings.

Improved Water Use Efficiency: Micro-Irrigation (MI) based technology

Micro-irrigation (MI) is proved to be an efficient method in saving water and increasing water use efficiency as compared to the conventional surface method of irrigation, where water use efficiency is only about 35-40 per cent or sometimes even less. The on-farm irrigation efficiency of properly designed and managed drip irrigation system is estimated to be about 90 per cent, while the same is only about 35 to 40 per cent for surface method of irrigation (INCID, 1994). In sprinkler irrigation method, water saving is relatively low (up to 70 per cent) as compared to drip irrigation since SIM supplies water over the entire field of the crop (INCID, 1998; Kulkarni, 2005, A. Narayanamoorthy, Dr.S.Raman). Thus, saving over the surface irrigation method through sprinkler irrigation and drip irrigation method would be 75% and 125%, simultaneously. In addition to above use of pipelines is also important for improving field efficiency. About 30-40% water can be saved by reducing the conveyance losses through using Pipelines.

Based on the above, the project would support various institutional, physical and modern water management practices with a view to promote sustainable water use available for agriculture, and improved water use efficiency. The project will also support promotion of on-farm water use efficiency measures, including drip and sprinkler irrigation & pipelines for irrigation water.

A. Integrated demonstration for Drip Irrigation System with Automation and fertigation based techniques for field crops

Micro irrigation along with automation and fertigation is getting popularity in horticultural crops but still the same needs to be percolated in wide spaced agricultural crops. It has been planned to lay this

technology by promotional support at the selected beneficiaries to demonstrate the effect of the technology and further replication. This will effectively improve the productivity and quality along with the water and labour saving. The package of technology along with the inputs required for first crop will be provided with an assistance of 75 per cent to the beneficiaries. Drip automation will be the optional/ need based item and it will be installed on the willingness of the beneficiary. The district unit will ensure the coordination of MI supplier and the Automation supplier (in case, they are separate entity) to make compatible commissioning and avoid duplication of the components. The estimated cost for the system with fertigation, automation along with crop demonstration is Rs.2.20 lac per ha. These technological demonstrations will be provided to the selected beneficiaries in the cluster by district unit of Agriculture department along with the other stakeholders.

B. Integrated demonstration for Mini/ Micro Sprinkler based techniques for field crops

Micro Irrigation based demonstrations for close space field crops like, Bajra, Sorghum, guar, pulses, Wheat, Mustard, Barley etc. has been proposed to improve the productivity per unit of water along with reduction in the production cost. The estimated cost for such demonstrations is Rs.1.45 lac per ha including automation and crop demonstration. Implementation process will be similar as in the case of drip technology activity.

C. Micro Irrigation –Drip, Mini/ Micro Sprinklers and Sprinklers:

The micro irrigation systems viz. Drip, Mini/ Micro Sprinklers and portable Sprinklers would be promoted on large scale in the cluster with a view to cover most of the irrigated area under such techniques. The per ha model cost of Drip, Mini/ Micro Sprinklers and portable Sprinklers is estimated to be Rs. 1.10,1.00 and 0.20 lacs respectively. The project assistance up to 75% is proposed to be provided to the beneficiaries.

D. Pipe line for piped conveyance of irrigation water:

Conveyance losses play a major role to increase/ decrease the irrigation efficiency. Traditionally, the farm water is conveyed through field channels which lead to leaching and evaporation losses. The conveyance of irrigation water at far ends of the farm through PVC/ HDPE pipelines leads to check such water losses. The estimated cost of 100 mts pipe line unit (generally sufficient to cover 1 ha) is Rs. 1.00 lacs and the project assistance of 75% has been proposed for this activity.

Technology Transfer and market led advisory services

Promoting adoption and documentation of improved technologies

This is the major activity where need based demonstrations to bridge the gap, improve productivity, to promote the efficient use of irrigation water, to enhance farm income, promote mechanisation and for the sustainability of agriculture have been proposed under the project. Field days, exposure visits, stakeholders' orientation and capacity building supportive activities have also been proposed for the effective adoption of the technologies. The detail of the activity is given as under:

b. Soil testing and distribution of Soil Health Cards

To know the fertility status of the farmer's field, soil testing will be done after taking soil samples from the farmer's field. After getting report of soil sample, the soil health card will be prepared and distributed to the farmers. The Dy. Director Agriculture would ensure soil testing and distribution of soil health cards to all the farmers of multi task groups of the cluster with convergence to the regular programme of the department. This activity needs to be completed within first year with the support of NGO. The district unit will train Multi Task Groups regarding process of taking soil samples from the fields.

c. Demonstrations on production technologies for value chain crops to bridge gap

The ICM demonstrations will preferably include the complete package of practices for a particular crop from land preparation to harvesting of the crop. Majority of the demonstrations will be on the value chain crops with a focus on popularizing high payoff interventions and reducing water foot print of the crop in the cluster. Demonstrations will also be conducted on other crops which are grown in a cropping sequence with the value chain crop with the objective of improving water use

efficiency, diversification to low water requiring, high value and other crops, reducing water foot print, etc. Another set of demonstrations will be on promoting resource conservation technologies and for popularizing climate smart agricultural practices. These demonstrations will need to be integrated with the on-farm water conservation structures developed under water sub-component of the project. The estimated cost for these demonstrations is Rs.10000 per ha including inputs and operations.

d. Demonstrations on Farm Mechanization and Post-Harvest Management (PHM) technologies

The objective of these demonstrations will be on promoting farm mechanization and Post-Harvest Management. Mechanization is the effective tool to reduce the production cost, increase the efficiency of farm and reduction in chemical weedicides. Medium category power operated/ self-propelled machines for field preparation, hoeing, weeding, planting, sowing, spraying, grading, harvesting etc. operations is included to encourage by assistance. PHM activities like farm level drying; cleaning, grading and post-harvest management of the harvested produce has also been included. It will also include provision of low cost plastic sheets to be used as movable threshing floor as well as for protection against damage by rain and water. The district unit will identify the potential implements for the cluster and will be made available to the farmers on 25% beneficiary's contribution.

e. Demonstrations on forage/ fodder

There is limited scope/ range of prevailing varieties of fodder in package of practices (POP). The programme planned to be implemented through outsourcing the agencies specified in fodder seed production. The range of fodder crops/ varieties which still could not be included in POP/ release may also be considered in the programme to foster the demand of fodder and new introduction. All inputs may be provided for these demonstrations and a part of the demonstration plot may be used for seed production of the same to ensure the seed availability of fodder crops/ varieties in the cluster. The estimated cost for such demonstrations is Rs.10000 per ha.

f. Promotion to seed production and adoption support

Seed Production: Special attention will be paid to technology empowerment of the farming community for production of quality seed of high yielding varieties of self-pollinated crops by organizing seed production demonstrations, including grading, packaging and certification and this program will be facilitated by NGO through Multi Task Groups. Seed production activity will be interlinked with FPO/ FCSC activity. Focus will be on improving the SRR of the cluster along with the improved income of the farmers. Tie-up will be made with certification and production agencies by the PIA.

Adoption Support: Quality seed of high yielding crop varieties is a critical input for increasing productivity. It also acts as a catalyst for the adoption of other improved crop husbandry practices. In view of the importance of seed in increasing crop productivity and the low seed replacement rates in the selected micro-clusters, adoption support in terms of 50% cost of seed will be provided to the farmers in the selected villages provided they give an undertaking to adopt the package of practices demonstrated for the value chain crop in the ICM demonstrations organized in that village in the preceding year. This will also help in tracking adoption rates of the demonstrated improved technologies by the farmers.

g. Innovative Activities/ INM/ IPM

The for foliar spray of micro nutrients, bio fertilizers, organic products, bio pesticides, IPM kits, pheromone traps, solar based light traps, wormy-compost units, tank based low pressure drip units, deionization units, nano-products for crop, other innovative techniques etc. are the activities which are proposed to be implemented as per need of particular crop/ technology with an assistance level of 75 percent.

Information and communication technologies (ICT) based demand driven participatory extension system (modernization of extension research linkages)

This activity pertains to creation of model information infrastructure at cluster level to support the beneficiaries for all the agricultural related problems along with the marketing support. The theme is to revitalize the existing extension system compatible with the modern techniques and farmers friendly software to support the farmers and grass root level staff on pilot basis. The KSK (Krishi Sewa Kendra) at cluster level will act as the problem solution/ technical back up and information centre, strengthened with IT and interlinked with the team of experts through software application. Efforts will be made for real time problem solution through IT enabled system. The KSK will also be strengthened with the literature, especially, related to potential threats led/ Pro-P based to support the grass root level staff for the precise identification and solution of major crop threats. The provision of technical back up from the experts at higher level has also been kept. Formation of a core team at project level to visualise and implementation monitoring of the ICT activities will be the axis of this activity.

a. KSK strengthening as model in project area-to serve as level I platform for ICT –

There is a provision of Kisan Sewa Kendra (KSK) among 2-3 Gram Panchayats in existing agriculture extension system of the state. It is felt that the KSK strengthening with modern information system is a must to fulfil the need of the beneficiary. Hence, 2 KSK in cluster have been proposed to be developed as modal KSK with modern infrastructure to serve as I level solution for the beneficiary. The model KSK will be strengthened by electronic devices, literature, furniture/ fixture, minor repairs and the operating costs.

b. Agriculture Research Institute strengthening to serve as level II/ III platform for ICT –

Each KSK needs to be backed up technically with the group of experts. It has been proposed that the existing Adaptive Trial Centre (ATC)/ Krishi Vigyan Kendra (KVK)/ Agriculture Research Station (ARS)/ Agriculture Research Sub Station (ARSS)/ ICAR Institute of the concerned district will be strengthened to support the model KSK.

c. Honorarium to the II/ III level experts for solution of the problems and facilitate field visits

ICT core team will assemble quarterly to review and monitor the progress of the activity. Expert at level I will be AS, AAO, AO, ARO and AD of concerned area. Expert panel for field problem solution at the level II and III will be finalised at PMU level. These will be provided excess to the software application where field problems in the form of text/ photo/ video will be uploaded by the farmer or KSK (which could not be solved at KSK level). The same may be got analysed by the panelled expert and online solution of the problem will be communicated. For each solution the honorarium will be provided to concerned expert. There should not be any repetition of problem/ solution. In some complex cases field visit may also be made. The main discipline of the experts will be Agronomy, Horticulture, Plant Breeding, Entomology, Plant Pathology, Nematology, Soil Science, Prop-P, Fertigation, Irrigation, Agribusiness, Post-Harvest Management etc. The honorarium in the range of Rs.200- 1000 will be provided to the different level of experts for providing the solutions of the farmers' problem. However, the honorarium will be decided at competent level.

d. Digital instruments to field coordinator/ staff–

It has been proposed that some kit of digital instruments viz. smart phone/ tablet, EC/ pH meter, digital/infrared thermometer/ hygrometer, GPS, digital camera, soil sample kit etc. to the field coordinator, technical experts/ AS/ AAO/ STA/ AO/ AD may be provided for the quick diagnosis of the problem. A set of some of these instruments will be provided according to the need of the particular cluster.

e. Potential threats led/ Pro-P based literature for crop crisis management on cluster specific crops

It is proved fact that each crop has some specific/ potential problems/ threats which are generally able to reduce the yield substantially. The Production with Protection (Pro-P) technique evolved by the departmental experts Dr. Prakash Kumar and Mr. Rajendra Singh provided a methodology to transfer and utilize high level diagnosis and treatment expertise to grass root level by prescribing a written treatment to the farmers on the base of 'diagnosis and recommendation photo sheets' prepared with the help of key subject experts. These prescriptions will promote the use of scientifically recommended biological pest control methods with specific and safe pesticides/ bio-products to control the identified problem. This technique has initiated on pilot basis in Kota Division during 2014-15. The 'diagnosis and recommendation photo sheets' will support and synergize the level I experts for the quick solution of field problems. These photo sheets will develop a professional way of prescription in departmental officials and discourage the practice of misleading prescription by some dealers/ sales persons. This literature is proposed to be made available to in the cluster for major potential crops.

f. Platform/ Software development to facilitate the problem solution at the I/II/III level and user interface-

Comprehensive platform/ software application will be developed to facilitate the beneficiaries and the expert to put the problems and solutions in a very simplified manner. The software will connect KSK, level I, level II, level III, selected beneficiaries, other stakeholders and PMU. The problem related to crops, production, plant protection, PHM, marketing etc. will be uploaded at the level of KSK/ cluster in the form of text or photo or video. The online solution will be provided by level I/ II/ III expert in most simplified way. The solution will be available/ accessible at KSK computer for the beneficiary. It will also be tried to communicate through some applications on the smartphone of grass root level officials and selected beneficiaries. The Project Management Unit (PMU) will be able to monitor the activity through the software itself. The software will be developed at PMU level. The software will also contain a set of technical information related to Agriculture sector. No provision has been kept at cluster level because this activity would be supported at PMU level.

Farmer Organization and Capacity Building

Capacity Building

Capacity building component is to be implemented on the cost norms of the RACP training manual. The cluster specific activities and the action plan in the limit of provisions should be prepared by concerned district unit. These programmes will run on year round basis.

Field days, exposure visits, orientation, capacity building-

Field days-For dissemination of the improved technologies demonstrated in the ICM demonstrations to large number of farmers, field days will be organized in the villages in which these demonstrations are organized. The field days will be organized near the harvesting or critical stage of the crop so that the farmers are able to see the differences between the prevalent farmer practice and the improved package of practices for a particular crop. Selection of fields/ beneficiaries will be made by concerned AD/DD/ DPMU through field coordinators, field staff and NGOs (if functional). Organise field days by the field staff, NGO and district coordinator with experts. PMU will approve the plan for field days.

Exposure visits- Exposure visits for farmers will be organized within the state and outside the state so that the farmers are able to see the successful production, post-harvest handling and marketing innovations developed at different places. For selection of the proposed locations to be visited/ beneficiaries by AD/ DD/DPMU, a proposal has to be sent and get approved by PIU/ PMU.

Farmer's Training: These will cover training and capacity building programs for farmers and farm women for adoption of knowledge-based crop husbandry and natural resource management/conservation practices for increasing productivity, enhancing diversification to high

value and low water requiring crops/practices for reducing water foot print of agriculture, enhancing farmer incomes and improving rural livelihoods.

Training of Service Provider Staff: These will cover training for program implementing staff about the project design, implementation arrangements, technical areas of crop production, post-harvest management and related aspects.

Orientation/ capacity building training- Orientation and capacity building training would be the on regular basis, as and when required.

Documentation of success stories: The success stories on specific issues may be documented in the form of text, photographs with text of small films/ movies. The proposals for the same may be sent to the PIU/ PMU.

To organize above several of trainings, Irrigation Management and Training Institute (IMTI) would be nodal agency. If specific trainings are needed during course of implementation, would be organized in state as well as national level Institute.

Procurement of inputs for technology demonstrations

The inputs viz. seeds, fertilizers, PP chemicals and bio-products need to be arranged for seed production program and adoption support, demonstrations on production technologies for value chain crops, fodder, integrated drip and mini sprinkler demonstrations. The agriculture inputs are to be procured from the Cooperative sector/ Govt Agri. Research Centre/ RSSC/ NSC/ SAUs/ RAJFED instead of competitive bidding because:

1. The cooperative/ public sector agencies have a strong network in the rural area through GSS, KVSS and their retail outlets which can cater the need of scattered beneficiary in the rural area.
2. These inputs have specific packing size but the project activities require different quantities which does not match the packing. The farmers/ beneficiaries and the field functionaries are in direct touch with these cooperative outlets. Thus, group of farmers may get the inputs collectively and distributed as per their requirement. It is practically not possible in the case of private suppliers.
3. Requirement of some inputs, especially, PP chemicals and bio-products depends on outbreak of particular insect/ pest/ disease/ weed which is practically not possible to predict precisely in advance. The procurement of such inputs within a very short notice is possible from these outlets to control the losses through infestation. The formalities of formal procurement will lose this beauty which may lead to worse consequences in the fields.
4. The inputs like seed, fertilizer and PP chemical are only sold by the licensed agencies/ firms. The licenses are governed as per respective Acts and regulations. Hence, supplies are restricted with the licensed firms only.
5. The major Fertilizers have the government control over rates. Hence, the rates for the same will be similar with each supplier. So procurement through tenders for such items does not make any logical sense.
6. The department of Agriculture has some set procedure to procure these inputs from the cooperative/ public sector agencies which prevails from long time. Moreover, field functionaries are not allowed to procure and store such inputs from private market. Hence, procurement through bidding process will be contradictory to the field functionaries

Annexure 5.2 Horticulture

Procurement of Planting Material of Fruit Plants and Inputs

The cooperative/public sector agencies have a strong network in the rural area through GSS, KVSS and their retail outlets which can cater the need of scattered beneficiary in the rural area.

These inputs have specific packing size but the project activities require different quantities which does not match the packing. The farmers/beneficiaries and the field functionaries are in direct touch with these cooperative outlets. Thus, group of farmer may get the inputs collectively and distributed as per their requirement. It is practically not possible in private suppliers.

Requirement of some inputs, especially, P.P. chemicals depends on outbreak of particular insect/ pest/ disease/ weed which is practically not possible to predict precisely in advance. The procurement of such inputs within a very short notice is possible from these outlets to control the losses through infestation. The formalities of formal procurement will lose this beauty which may lead to worse consequences in the fields.

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The department of Agriculture has some set procedure to procure these inputs from the cooperative/ public sector agencies which prevails from long time. Moreover, field functionaries are not allowed to procure and store such inputs from private market. Hence, procurement through bidding process will be contradictory to the field functionaries.

The requirement of planting material is very small and cluster specific according to selected value chain crop. Most of the planting material is imported from other State like Gujarat, Maharashtra, and Uttar Pradesh etc. Planting material is very soft and succulent and intend to high motility during transport so that it is not feasible to procure the small quantity of different kind of planting material from different States. RAJHANS is the only option for timely supply of planting material due to availability of all kind of planting material in their local nurseries. RAJHANS grows planting material in their 27 nurseries and also procure the planting material from different State and provide quality hybrid or grafted planting material in State.

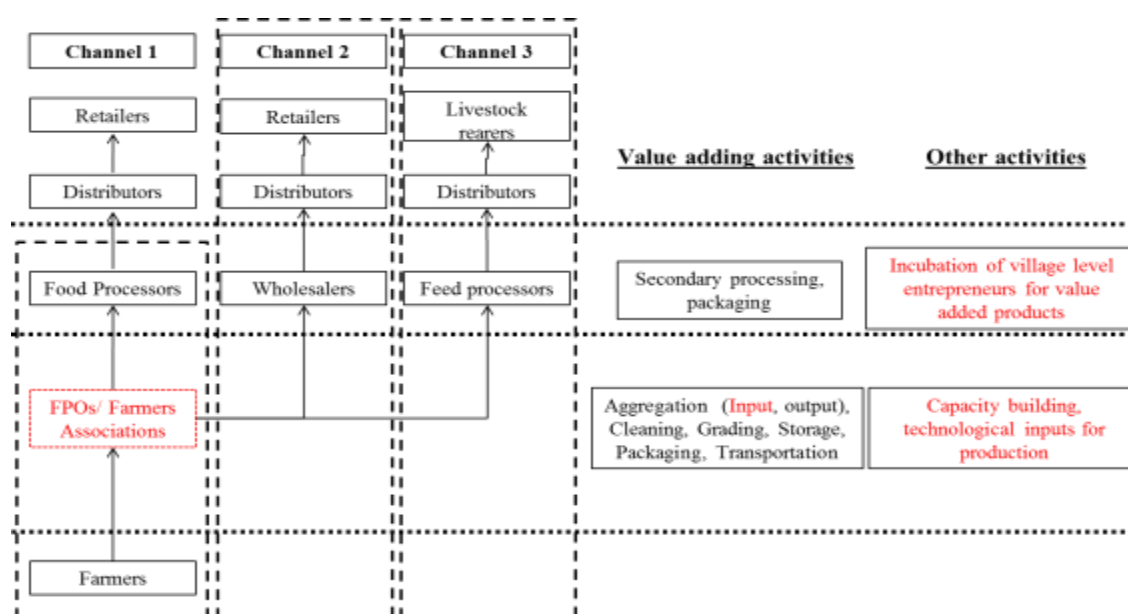
Annexure 5.3: Post intervention value chain map

1. Bajra

In the post intervention value chain a third channel may be developed targeting value-added products like multi-grain flour (by large players like Ashirvad), breakfast cereals (Kellogg), also large players like Cargill for animal feed. Also, the restructured value chain will have PCs and their FCSC replacing Mandi's and undertaking aggregation plus grinding and sorting and packaging services. The PCs may need input facilitation, custom hiring and marketing of produce.

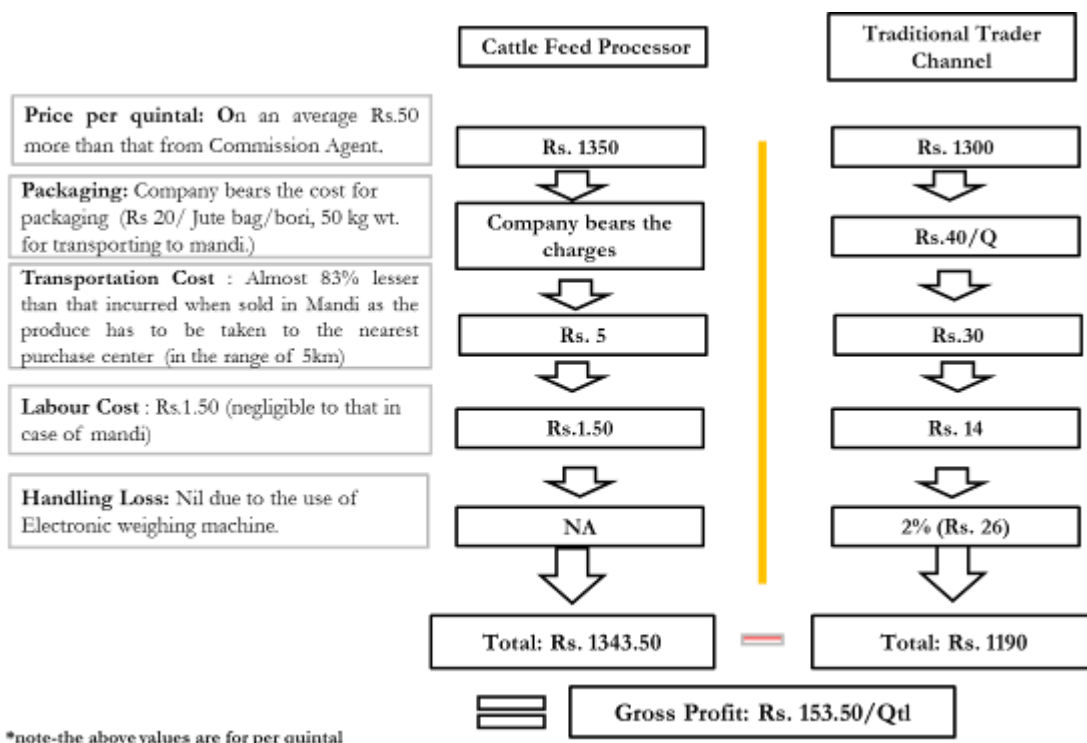
The unavailability of HYV of bajra for farmers is a critical constraint experienced by farmers. In this context, a seed production programme need to be launched availing the services of players Raj seeds. Also, limitation in terms of threshers and harvester combines are apparent. At the post-harvest stage there are constraints in terms of high moisture content, storage facility, high level of dirt and impurities in harvested which may be addressed through common facilities. There is also scope enterprises/links with large players like Cargill etc. Dissemination of benefits of direct Purchase license and apt contract farming modes are other related interventions.

Figure 16: Scope of interventions in value chain of Bajra



A comparative chart of Bajra shows the value chain difference between the incremental profits realized by farmers by going with leading value chain players channel rather traditional trader channel.

Figure 17: Value chain difference between the incremental profits realized by farmers



2. Green gram

In the envisaged post- intervention restructured value chain, channel 1, 2 and 3 will have developed alternate marketing channels where FCSCs will not only play the role of facilitator (as aggregator for farmer produce) for institutional procurement but also play the role of an alternate private market yard and will undertake basic primary processing (grading, sorting and packing) of green gram. In addition, an alternate marketing channel for supplying to large distributors or even large retailers like Tata Rallis may be developed. The FCSCs can also offer gamut of other services to members in terms of input facilitation, custom hiring as well as facilitating market connectivity.

The restructuring of the chain will also involve catalysing value added units in a range of snacks and feed as individual enterprise start-ups.

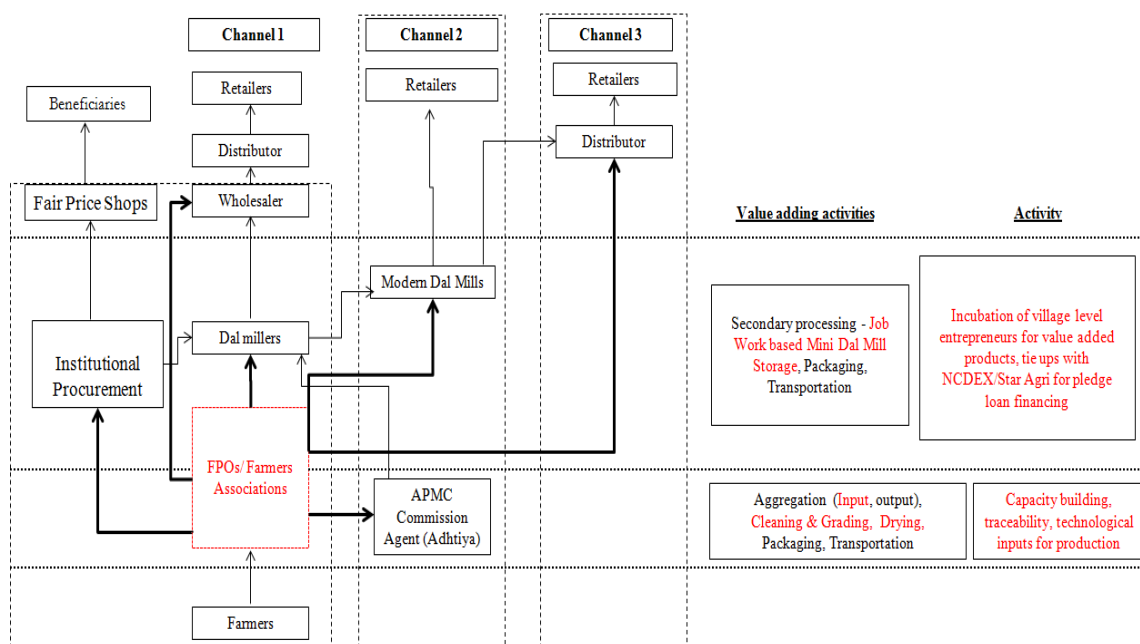


Figure 18: Indicative post-intervention value chain map of Green gram

3. Isabgol

The indicative post intervention value chain suggests FPC of growers to take up procurement from farmers and sell the seeds after sorting grading directly to Unjha mandi or to processors. When the FPC gains experience and understands the dynamics of the front end of the market, it may also enter into Isabgol husk making and supply directly to distributors so that it may earn higher margins.

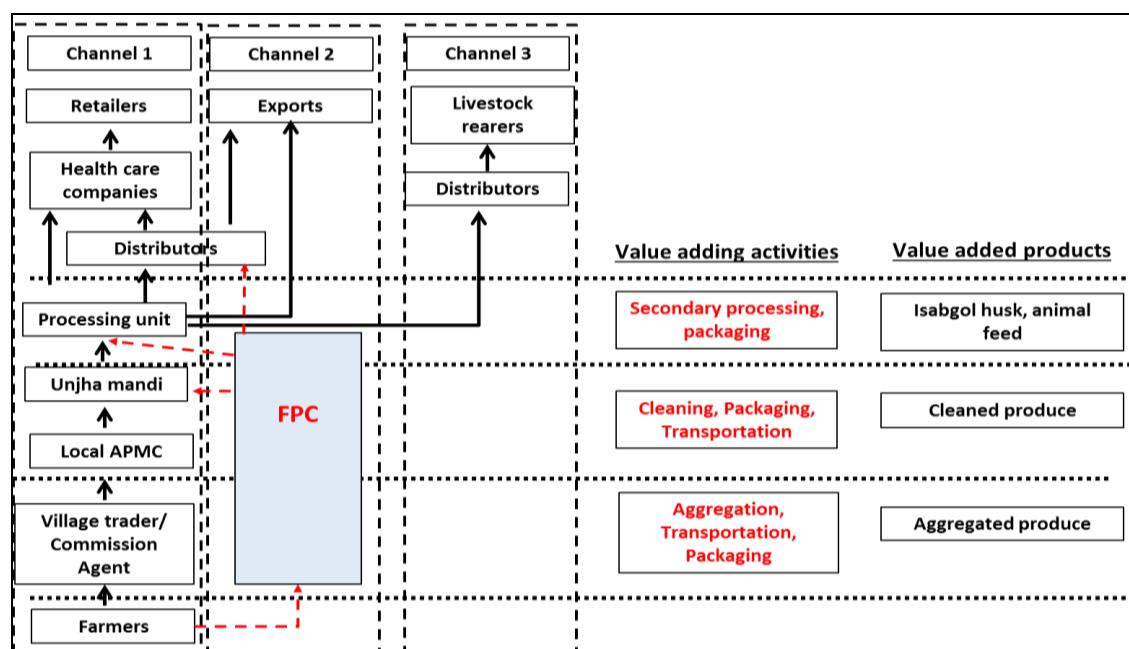


Figure 19: Indicative post-intervention value chain map of Isabgol

4. Goat

An indicative post intervention value chain map for goat milk is shown below:

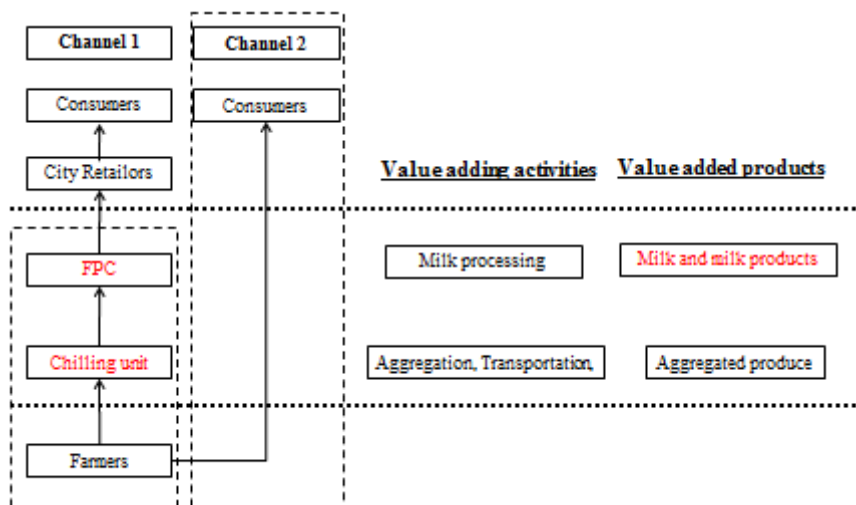
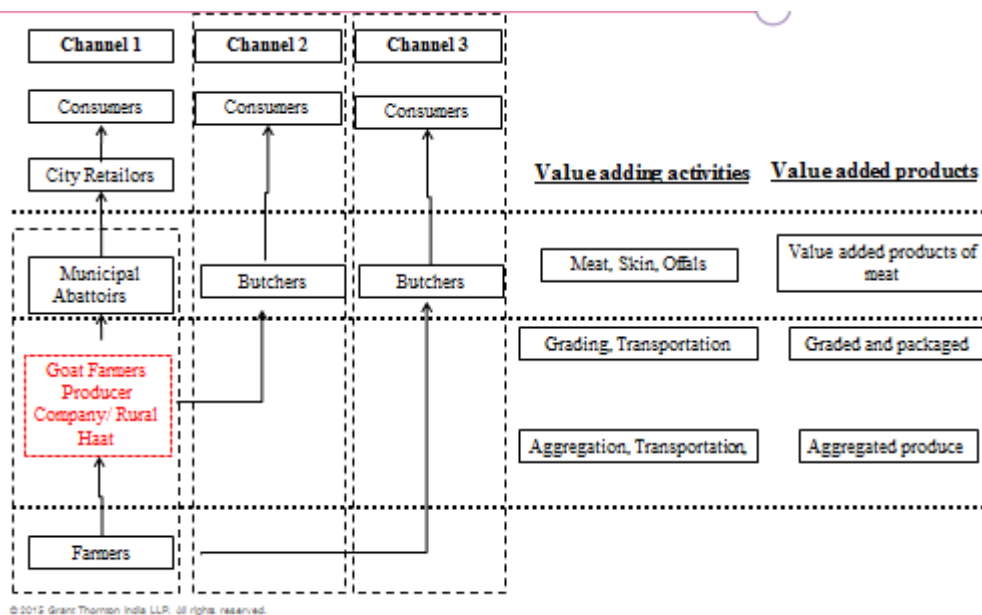


Figure 20 Indicative Post intervention value chain map of Goat milk

A value chain study on goat meat has been done and the value chain map for goat meat is shown below:



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Figure 21 Indicative Post intervention value chain map for goat meat

Annexure 5.4: Activities for soft intervention

Scouting of technologies and business ideas for such identified commodities

The ABPF shall scout for new and innovative models in agriculture and allied sector for developing local entrepreneurship for providing productive services to value chain stakeholders.

It shall include the following activities, but not limited to: (i) review of literature, (ii) participatory meetings with market participants and representatives of relevant business models such as – producers, aggregators, transport facilitators, storage facilitators, commission agents, wholesalers, retailers and ultimate consumers, (iii) field work (surveys on existing cold stores, pack houses, ripening rooms etc., surveys to assess the potential for establishing new marketing venture for FCSC, E-Trading and the role of local aggregators), (iv) analysis of the data / information, (v) feedback from market participants & relevant agencies, (vi) sharing the business models on a web platform.

Incubation services to Agri-entrepreneurs

ABPF shall provide agri-business incubation services, with the objective to identify, mobilize and groom emerging agro entrepreneurs and CBOs.

Training on market research methodologies, business proposals, business skills, business plan preparation, grants access, financial linkages and market linkage, legal framework, etc. to establish own business through competent trainers subject to approval from PMU-RACP.

ABPF shall also empower the youth and women to start their agri-business resulting in their social and economic development. At least 10% women candidates are desirable among the candidates trained under incubation program. The ABPF will be responsible for networking with other entrepreneurs, customers and other support agencies; provide mentorship support through development of a resource base of mentors, and subsequently ensure their deployment.

Management and Business Training to FCSC and Producer Companies personnel

The ABPF shall undertake training for management & business skill building for personnel of the Producers' Companies (PCs) and Farmer Common Service Centres (FCSCs) under the project. The ABPF shall develop comprehensive training plan.

Training is provided to personnel with an objective of enhancing the knowledge & skills of PC personnel (related to management of FCSC) for efficiently facilitating management & business of the FCSC.

#	Name of Component	Name of sub-component
1	Capacity building	Field days, exposure visits, orientation, capacity building
		Field days
		Exposure visits (Within state)
		Exposure visits (Out of state)
		Orientation
		Capacity Building

Facilitating Agri Policies

Agro-Processing and Agri-Marketing has been included as a Thrust sector in RIPS 2014. All Agro-Processing and Agri-Marketing Units shall be eligible for benefits under RIPS 2014.

Following additional incentives would be admissible under this Policy after obtaining the entitlement certificate under RIPS 2014.

Incentive for market development and diversification:

- Transport subsidy on export of the spices
- Subsidy on the export insurance
- Vehicle Registration Concession (Reefer vans and chilled milk transportation vehicles)
- Incentives for quality and certification
- Incentive for project development
- Transport subsidy on export of Fruits & vegetables
- Incentive for Research & Development
- Incentives in Land Related Issues

It shall also facilitate agriculture policy seminars thereby providing a forum for stakeholders (agri industry, NGOs, PCs, Govt. bodies, etc.) in Rajasthan to discuss improvements to the agribusiness investment climate.

Linking producers and producer groups to the market

The ABPF shall retain the important role to identify and develop linkages between producers and processors so that return realized should be greater and major part of the consumer money should go down to the producer.

Market Information services

After the analysis of the existing information services, there is a scope of development of online portal based on the inputs from mobile based application as well as conventional method. As a pilot intervention, such portal can be developed to cater to the cluster area and which can gradually be rolled over to the whole district and eventually the state.

Existing sources of information services are as follows:

a. Mobile based applications

• Agmarknet

AGMARKNET portal also providing market information by connecting more than three thousand regulated markets of country to the farmers but due to lack of awareness and computer system, farmers are unable to access it. AGMARKNET Portal provides following information to farmers:

- Dissemination of market information for arrivals and prices of crops grown across the states without the limit of geographical boundaries
- Provides information on weather forecast, crop advice, use of fertilizers & pesticides etc.
- Up loads latest research reports related to marketing and analysis of information and trends in prices, demand on continual basis.

The sampled farmers were not using this facility as they are unaware about these facilities. However, they get market information from fellow farmers and traders.

IKSL –Iffco Kisan Samridhi ltd. is offering voice based message services in this area.

b. Conventional method

• Kisan Call Center (1800-180-1551)¹

The country today has an impressive telecom network both in the private and Government sector. Over 5 lakh villages have a public telephone in the country. It has been felt for long that this impressive telecom network could be put to effective use for delivering knowledge and information to the farming community. A call centre based extension service will be delivering knowledge and information exactly as per the requirements of the farming community. This system would also help to keep a record of what is being delivered to the farmers in terms of knowledge and information. The Kisan Call Centre scheme is available throughout the country. The Kisan Call Centre scheme has been functioning from 21.1.04. **The Call Centres can be accessed by farmers all over the country on common Toll Free Number 1800-180-1551.** Since 10th June, 2004, the Call Centres service has been made available right from 6 A.M. to 10 P.M. except on Sundays and gazetted holidays, beyond these hours the calls are attended in the voice recording mode.

The calls are received at 13 Call Centres wherein 116 Agriculture Graduates attend to answer the queries of the farmer in the local language. 123 experts located in different parts of the country at State Agriculture Universities, ICAR institutes, State Department of Agriculture, Horticulture and other developments are answering the calls at Level –II.

The SMS service has been started by the National Bank for Agriculture and Rural Development (NABARD) in collaboration with the India Meteorological Department (IMD, agrimet division). The focus of the project includes meteorological advisory services to the farmers, bringing together experts and grass-root level communities with the objective of making knowledge accessible to farmers, dissemination of agriculture advisory and feedback from farmers through the involvement of farmers clubs, joint liability groups, village watershed committees in area where watershed projects are being implemented and research and development in operational agriculture meteorology.

• India Meteorological Department

The service is provided by the India Meteorological Department, under the Ministry of Earth Sciences of Government of India. The IMD has set up nine agromet field units (AMFU) in the state. After these units get the forecast, they prepare agro advisory with the help of experts. This advisory is sent to IMD where the bulletin is composed and then disseminated to farmers through SMS, radio, newspapers and other means.

• Tata Consultancy Services (TCS)

The Tata Group's information and technology firm created a customizable Mobile Agro Advisory System called mKrishi that would address farmers' specific queries in real time. The name mKrishi combines "m" for mobile and "krishi," which refers to agriculture in many Indian languages.

¹<http://liferajasthan.blogspot.in/2011/04/know-kissan-call-center-1800-180-1551.html>

Annexure 5.5 Profit and loss statement for FCSC units

Table 52: Profit and loss statement of Green gram cleaning grading and mini dal mill unit

Particulars	Y1	Y2	Y3	Y4	Y5
Cleaning and Grading	1,036,800	1,179,360	1,333,584	1,500,282	1,680,316
Dal Revenue	7,918,560	8,482,698	9,083,453	9,723,078	10,403,956
Job Work	378,000	429,975	486,203	546,978	612,615
Total Revenue	9,333,360	10,092,033	10,903,240	11,770,337	12,696,887
Fixed Cost	979,500	1,028,475	1,079,899	1,133,894	1,190,588
Variable Cost	7,323,000	7,876,312	8,466,648	9,096,327	9,767,808
Total Operational Expenses	8,302,500	8,904,787	9,546,547	10,230,221	10,958,396
Earnings Before Interest, Depreciation, Taxes and Amortization (EBITDA)	1,030,860	1,187,246	1,356,693	1,540,116	1,738,491
Depreciation	247,500	247,500	247,500	247,500	247,500
Amortization	-	-	-	-	-
Earnings Before Interest and Taxes (EBIT)	783,360	939,746	1,109,193	1,292,616	1,490,991
Interest Expense	39,738	39,399	39,275	39,334	39,550
Earnings Before Taxes (EBT)	743,622	900,347	1,069,918	1,253,283	1,451,440
Tax	183,429	248,659	315,500	384,583	456,505
Earnings After Taxes (EAT)	560,193	651,688	754,417	868,699	994,935

Bajra cleaning and grading lab

Table 53 Profit and loss statement of Bajra Cleaning and grading unit

Particulars	Y1	Y2	Y3	Y4	Y5
CnG Service	1,536,000	1,713,600	1,905,120	2,111,508	2,333,772
Total Revenue	1,536,000	1,713,600	1,905,120	2,111,508	2,333,772
Fixed Cost	383,000	402,150	422,258	443,370	465,539
Variable Cost	360,000	378,000	396,900	416,745	437,582
Total Operational Expenses	743,000	780,150	819,158	860,115	903,121
Earning Before Interest, Depreciation, Taxes and Amortization (EBITDA)	793,000	933,450	1,085,963	1,251,393	1,430,651
Depreciation	268,500	268,500	268,500	268,500	268,500
Amortization	-	-	-	-	-
Earnings Before Interest and Taxes (EBIT)	524,500	664,950	817,463	982,893	1,162,151
Interest Expense	-	-	-	-	-
Earnings Before Taxes (EBT)	524,500	664,950	817,463	982,893	1,162,151
Tax	115,180	176,976	239,848	304,447	371,384
Earnings After Taxes (EAT)	409,320	487,974	577,615	678,446	790,766

Goat milk chilling unit

Table 54 Profit and Loss statement for Goat milk chilling unit

Particulars	Y1	Y2	Y3	Y4	Y5
Milk Product	4,015,000	4,742,719	5,533,172	6,390,814	7,320,386
Total Revenue	4,015,000	4,742,719	5,533,172	6,390,814	7,320,386
Fixed Cost	221,000	232,050	243,653	255,835	268,627
Variable Cost	3,016,798	3,563,593	4,157,525	4,801,941	5,500,405
Total Operational Expenses	3,237,798	3,795,643	4,401,177	5,057,776	5,769,032
Earning Before Interest, Depreciation, Taxes and Amortization (EBITDA)	777,202	947,076	1,131,995	1,333,037	1,551,354
Depreciation	142,388	142,388	142,388	142,388	142,388
Amortization	-	-	-	-	-
Earnings Before Interest and Taxes (EBIT)	634,815	804,689	989,607	1,190,650	1,408,967
Interest Expense	177,734	184,707	163,556	139,598	112,462
Earnings Before Taxes (EBT)	457,081	619,982	826,051	1,051,052	1,296,505
Tax	137,124	185,995	247,815	315,316	388,952
Earnings After Taxes (EAT)	339,406	442,149	576,164	724,489	887,993

Annexure 6.1: Watershed area distribution

Table 55: Micro Watershed-wise Area for water budgeting purpose

S. No.	Macro No.	Micro No.	Name of Village	Micro W/S area (in ha)
1	6	4	Mahanpur, Machi	537
2	6	5	Mahanpur, Machi, Meerapur	365
3	6	6	Mahanpur	505
4	6	7	Mahanpur, Loyati	210
5	6	8	Loyati, Mahanpur, NangalBhaw Singh, Keherpura, Babera, BhuriDungri, Kothal, Buteri, Kankaria,	992
6	6	9	Loyati, Mahanpur, Shyampura, Uchpur, BadDhundla, Kothal, Sathalpur	885
7	6	10	Mahanpur	92
8	7	1	Alampur, Kharkhra, Shyampura, Rasnali Main	912
9	7	2	Bas Dayal, Kharkhra, Khoheri, Rasnali Main, Khiwaheri, Bas Karnawat Main, Milakpur	1325
10	7	3	Bas Dayal, Khoheri, Bas Karnawat Main, Neemuchana Main	980
11	7	4	Burja, Khoheri, Chaterpura, Neemuchana Main,	1250
12	7	5	Burja, Pali main, Neemuchana	490
13	7	6	Burja Main, Gyanpura, Chaterpura	470
14	8	1	Alampur, Nawalpura, Shyampura, Rasnali, Milakpur	872
15	8	2	Nawalpura, Shyampura	155
16	8	3	Khoheri, Nawalpura, Indrada, Milakpur	345
17	8	4	Khoheri, Prathvipura, Indrada, Holawas, Chaterpura, Gadi	1750
18	8	6	Basna, Bisalu	115
19	8	7	Basna, Bilat, Bisalu	685

(Source: Watershed DPR, Dooni)

Annexure 6.2: Assessment of Groundwater Recharge from Rainwater Harvesting Structures

The project is important for semi-arid regions of Rajasthan especially for hard-rock areas, which makes it difficult to apply basic hydrologic principles derived for alluvial and unconsolidated geologic formations. The study area, is situated in hard-rock region of Udaipur district. Therefore, the results of the study will be mainly applicable to other hard-rock regions of India. The results will definitely be useful for the planners, researchers and decision makers in the study area to formulate suitable strategies for implementing artificial recharge projects on large scale.

Groundwater recharge is one of the vital components of the water cycle and is highly uncertain to be predicted accurately. In hard-rock areas of Rajasthan, cost-effective and feasible methods for artificial groundwater recharging have not been identified. Also, studies on evaluating impact of artificial groundwater recharge on improving groundwater quality are rare.

Water scarcity and depletion of groundwater levels are among the major problems in southern Rajasthan. During May-June every year, most of the wells become dry due to decline in groundwater levels. Artificial recharge of groundwater seems to be an appropriate solution under the present situation. It has been observed that rainwater harvesting-cum-groundwater recharging structures play an effective role in augmenting groundwater tables in the region. The small water harvesting ponds/Anicuts get submerged atleast two times during the entire monsoon season depending on rainfall and other watershed characteristics. In this study the recharge rate and recharge volume through a small masonry check dam/ anicut is determined by monitoring the inflow of runoff and percolation from the reservoir through staff gauge.

Preparation of Depth Capacity Curve for Shishvi Water Harvesting Structure

During the monsoon period of 2012 to 2015 daily surface water levels of water harvesting structure as well as the water table of identified open dug well were monitored to find out the impact of constructed structure for groundwater recharging. During the monsoon months, the constructed structure gets completely filled up two to three times because of occurrence of normal rainfall and its proper distribution. Depth-capacity curve of the structure was prepared by preparing contour map of the submergence area. The capacity of the pond at different depth is given in Table 1. The prepared depth-capacity curve is shown in Fig. 1

Table 56 Storage capacity of groundwater recharges structures constructed at Shishvi

Contour Value	Depth (m)	Capacity (m ³)
98.50	0.5	250.00
99.00	1.0	992.50
99.50	1.5	2285.00
100.00	2.0	4235.00

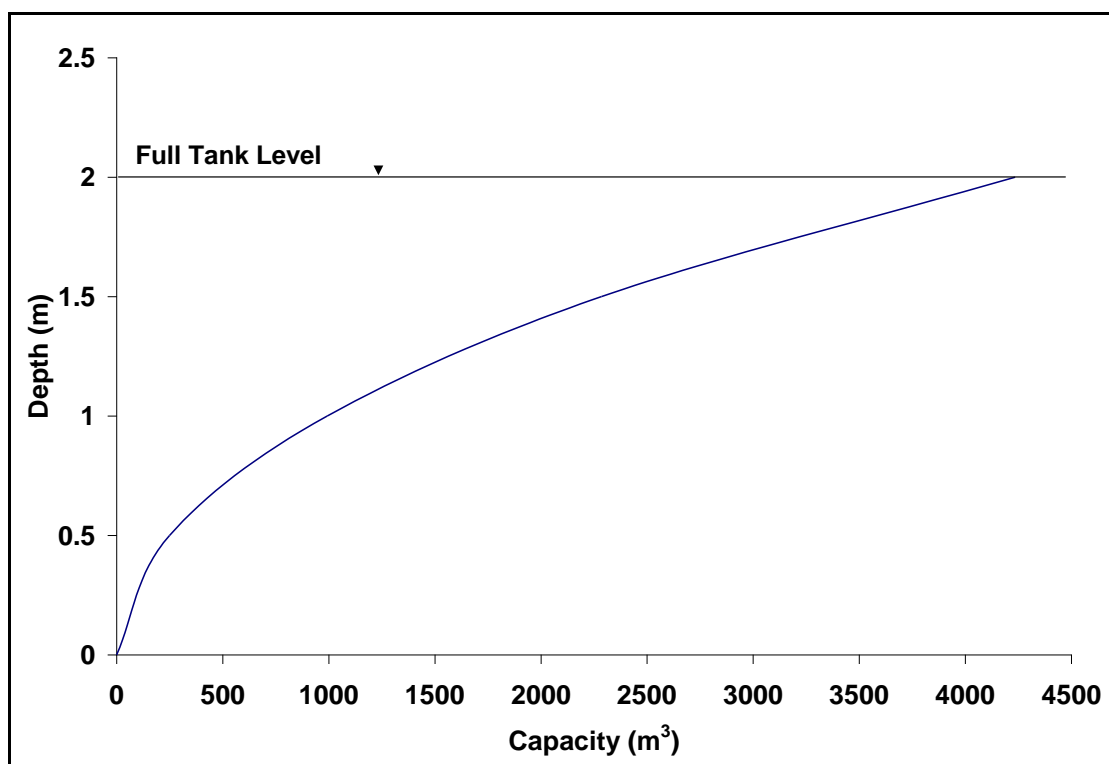


Figure 22 Depth-Capacity Curve of Shishvi Water Harvesting Structure

Assessment of Groundwater Recharge through Rainwater Harvesting Structure Constructed at Shishvi

For assessment of groundwater recharge through rainwater harvesting structures, daily monitoring of surface water level were carried out through the installation of gauge in the Anicut. The water table of the identified open dug well situated in the downstream side of the structure were also measured on daily basis. The pan-evaporation data were collected from the CTAE Meteorological Observatory. The collected data were analyzed for computation of groundwater recharge and recharge rate through the construction of water harvesting structure. The average recharge rate was found to be 3.95 cm/day whereas net recharge volume was 7902.28 m³ for the year 2015. The net recharge as well as recharge rate is shown in Table 2 and Table 3.

Table 57 Estimation of Recharge Rate through Water Harvesting Structure Constructed at Shishvi

Date	Rainfall (mm)	Water level (meters)	Depletion/ addition (meters)	Pan Evaporation (mm)	Actual Evaporation (mm)	Recharge (cm)
1	2	3	4	5	6	7
16-06-2015	27.00	0.30	0.00	7.20	5.04	0.00
17-06-2015	10.60	0.38	0.04	2.60	1.82	3.82
18-06-2015	6.80	0.40	0.04	5.80	4.06	3.59
19-06-2015	0.00	0.32	0.08	8.30	5.81	7.42
20-06-2015	0.00	0.25	0.07	8.60	6.02	6.40
21-06-2015	0.00	0.17	0.08	7.50	5.25	7.48
22-06-2015	0.00	0.10	0.07	6.40	4.48	6.55
23-06-2015	12.20	0.15	0.04	4.00	2.80	3.72
24-06-2015	0.00	0.06	0.09	4.00	2.80	8.72
25-06-2015	0.00	0.00	0.00	5.50	3.85	0.00
26-06-2015	0.00	0.00	0.00	6.10	4.27	0.00
27-06-2015	0.00	0.00	0.00	6.30	4.41	0.00
28-06-2015	0.00	0.00	0.00	5.50	3.85	0.00
29-06-2015	0.00	0.00	0.00	5.70	3.99	0.00
30-06-2015	0.00	0.00	0.00	6.00	4.20	0.00
01-07-2015	0.00	0.00	0.00	5.90	4.13	0.00
02-07-2015	0.00	0.00	0.00	4.80	3.36	0.00

Date	Rainfall (mm)	Water level (meters)	Depletion/ addition (meters)	Pan Evaporation (mm)	Actual Evaporation (mm)	Recharge (cm)
1	2	3	4	5	6	7
03-07-2015	0.00	0.00	0.00	5.70	3.99	0.00
04-07-2015	0.00	0.00	0.00	5.60	3.92	0.00
05-07-2015	0.00	0.00	0.00	5.90	4.13	0.00
06-07-2015	0.00	0.00	0.00	6.20	4.34	0.00
07-07-2015	0.00	0.00	0.00	6.40	4.48	0.00
08-07-2015	0.00	0.00	0.00	5.60	3.92	0.00
09-07-2015	0.00	0.00	0.00	5.30	3.71	0.00
10-07-2015	0.00	0.00	0.00	5.30	3.71	0.00
11-07-2015	0.00	0.00	0.00	5.50	3.85	0.00
12-07-2015	0.00	0.00	0.00	5.10	3.57	0.00
13-07-2015	0.00	0.00	0.00	4.90	3.43	0.00
14-07-2015	0.00	0.00	0.00	5.60	3.92	0.00
15-07-2015	0.00	0.00	0.00	6.10	4.27	0.00
16-07-2015	0.00	0.00	0.00	4.80	3.36	0.00
17-07-2015	0.00	0.00	0.00	4.30	3.01	0.00
18-07-2015	0.00	0.00	0.00	3.30	2.31	0.00
19-07-2015	12.20	0.00	0.00	1.80	1.26	0.00
20-07-2015	0.00	0.00	0.00	0.80	0.56	0.00
21-07-2015	25.00	0.65	0.04	1.10	0.77	3.92
22-07-2015	0.00	0.60	0.05	2.00	1.40	4.86
23-07-2015	25.70	1.35	0.04	2.20	1.54	3.85
24-07-2015	19.00	1.65	0.04	2.20	1.54	3.85
25-07-2015	0.00	1.58	0.07	1.60	1.12	6.89
26-07-2015	12.20	1.70	0.04	1.60	1.12	3.89
27-07-2015	32.00	2.00	0.04	0.80	0.56	3.94
28-07-2015	0.00	1.94	0.06	0.70	0.49	5.95
29-07-2015	67.40	2.00	0.04	0.60	0.42	3.96
30-07-2015	0.00	1.94	0.06	1.20	0.84	5.92
31-07-2015	0.00	1.89	0.05	1.80	1.26	4.87
01-08-2015	0.00	1.84	0.05	3.00	2.10	4.79
02-08-2015	0.00	1.78	0.06	4.30	3.01	5.70
03-08-2015	0.00	1.73	0.05	5.40	3.78	4.62
04-08-2015	0.00	1.68	0.05	5.50	3.85	4.62
05-08-2015	0.00	1.61	0.07	6.00	4.20	6.58
06-08-2015	0.00	1.54	0.07	6.00	4.20	6.58
07-08-2015	0.00	1.49	0.05	5.60	3.92	4.61
08-08-2015	0.00	1.42	0.07	5.20	3.64	6.64
09-08-2015	0.00	1.36	0.06	5.40	3.78	5.62
10-08-2015	0.00	1.31	0.05	4.30	3.01	4.70
11-08-2015	0.00	1.24	0.07	1.30	0.91	6.91
12-08-2015	43.20	2.00	0.04	0.20	0.14	3.99
13-08-2015	0.00	1.96	0.04	1.30	0.91	3.91
14-08-2015	0.00	1.91	0.05	2.00	1.40	4.86
15-08-2015	43.20	2.00	0.04	1.90	1.33	3.87
16-08-2015	0.00	1.95	0.05	3.10	2.17	4.78
17-08-2015	10.40	2.00	0.04	1.40	0.98	3.90
18-08-2015	7.40	1.96	0.04	1.50	1.05	3.90
19-08-2015	0.00	1.90	0.06	2.20	1.54	5.85
20-08-2015	0.00	1.83	0.07	4.20	2.94	6.71
21-08-2015	0.00	1.76	0.07	2.90	2.03	6.80
22-08-2015	0.00	1.70	0.06	3.20	2.24	5.78
23-08-2015	0.00	1.66	0.04	4.40	3.08	3.69
24-08-2015	0.00	1.60	0.06	4.70	3.29	5.67
25-08-2015	0.00	1.55	0.05	4.50	3.15	4.69
26-08-2015	0.00	1.49	0.06	5.10	3.57	5.64
27-08-2015	0.00	1.45	0.04	4.80	3.36	3.66
28-08-2015	0.00	1.40	0.05	5.30	3.71	4.63
29-08-2015	0.00	1.34	0.06	4.70	3.29	5.67
30-08-2015	0.00	1.29	0.05	4.80	3.36	4.66

Table 58 Estimation for Recharge Volume through Water Harvesting Structure at Shishvi

Date	Rainfall (mm)	Water Level (m)	Depletion/ Addition (m)	Volume of Storage (m ³)	Surface Area (m ²)	Volume of Depletion (m ³)	Volume of Actual Evaporation (m ³)	Net Recharge (m ³)
16-06-2015	27.00	0.30	0.00	150	180	0.00	0.00	0.00
17-06-2015	10.60	0.38	0.04	190	227	9.08	0.41	8.67
18-06-2015	6.80	0.40	0.04	200	240	9.60	0.97	8.63
19-06-2015	0.00	0.32	0.08	160	190	15.20	1.10	14.10
20-06-2015	0.00	0.25	0.07	125	149	10.43	0.90	9.53
21-06-2015	0.00	0.17	0.08	89	104	8.32	0.55	7.77
22-06-2015	0.00	0.10	0.07	76	64	4.48	0.29	4.19
23-06-2015	12.20	0.15	0.04	87	82	3.28	0.23	3.05
24-06-2015	0.00	0.06	0.09	48	40	3.60	0.11	3.49
25-06-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
26-06-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
27-06-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
28-06-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
29-06-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
30-06-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
01-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
02-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
03-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
04-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
05-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
06-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
07-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
08-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
09-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
10-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
11-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
12-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
13-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
14-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
15-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
16-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
17-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
18-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
19-07-2015	12.20	0.00	0.00	0	0	0.00	0.00	0.00
20-07-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
21-07-2015	25.00	0.65	0.04	539	469	18.76	0.36	18.40
22-07-2015	0.00	0.60	0.05	275	432	21.60	0.60	21.00
23-07-2015	25.70	1.35	0.04	2060	1770	70.80	2.73	68.07
24-07-2015	19.00	1.65	0.04	3078	2175	87.00	3.35	83.65
25-07-2015	0.00	1.58	0.07	2407	2013	140.91	2.25	138.66
26-07-2015	12.20	1.70	0.04	3166	2251	90.04	2.52	87.52
27-07-2015	32.00	2.00	0.04	4235	2722	108.88	1.52	107.36
28-07-2015	0.00	1.94	0.06	4108	2641	158.46	1.29	157.17
29-07-2015	67.40	2.00	0.04	4235	2722	108.88	1.14	107.74
30-07-2015	0.00	1.94	0.06	4108	2641	158.46	2.22	156.24
31-07-2015	0.00	1.89	0.05	4002	2573	128.65	3.24	125.41
01-08-2015	0.00	1.84	0.05	3896	2436	121.80	5.12	116.68
02-08-2015	0.00	1.78	0.06	3288	2336	140.16	7.03	133.13
03-08-2015	0.00	1.73	0.05	3222	2290	114.50	8.66	105.84
04-08-2015	0.00	1.68	0.05	3130	2224	111.20	8.56	102.64
05-08-2015	0.00	1.61	0.07	2999	2132	149.24	8.95	140.29
06-08-2015	0.00	1.54	0.07	2355	1967	137.69	8.26	129.43
07-08-2015	0.00	1.49	0.05	2270	1906	95.30	7.47	87.83
08-08-2015	0.00	1.42	0.07	2163	1880	131.60	6.84	124.76
09-08-2015	0.00	1.36	0.06	2072	1715	102.90	6.48	96.42
10-08-2015	0.00	1.31	0.05	1996	1540	77.00	4.64	72.36

Date	Rainfall (mm)	Water Level (m)	Depletion/ Addition (m)	Volume of Storage (m ³)	Surface Area (m ²)	Volume of Depletion (m ³)	Volume of Actual Evaporation (m ³)	Net Recharge (m ³)
11-08-2015	0.00	1.24	0.07	1626	1457	101.99	1.33	100.66
12-08-2015	43.20	2.00	0.04	4235	2722	108.88	0.38	108.50
13-08-2015	0.00	1.96	0.04	4150	2668	106.72	2.43	104.29
14-08-2015	0.00	1.91	0.05	4044	2600	130.00	3.64	126.36
15-08-2015	43.20	2.00	0.04	4235	2722	108.88	3.62	105.26
16-08-2015	0.00	1.95	0.05	4129	2654	132.70	5.76	126.94
17-08-2015	10.40	2.00	0.04	4235	2722	108.88	2.67	106.21
18-08-2015	7.40	1.96	0.04	4150	2668	106.72	2.80	103.92
19-08-2015	0.00	1.90	0.06	4023	2587	155.22	3.98	151.24
20-08-2015	0.00	1.83	0.07	3875	2423	169.61	7.12	162.49
21-08-2015	0.00	1.76	0.07	3278	2330	163.10	4.73	158.37
22-08-2015	0.00	1.70	0.06	3166	2251	135.06	5.04	130.02
23-08-2015	0.00	1.66	0.04	3095	2190	87.60	6.75	80.85
24-08-2015	0.00	1.60	0.06	2703	2080	124.80	6.84	117.96
25-08-2015	0.00	1.55	0.05	2360	1975	98.75	6.22	92.53
26-08-2015	0.00	1.49	0.06	2270	1906	114.36	6.80	107.56
27-08-2015	0.00	1.45	0.04	2239	1898	75.92	6.38	69.54
28-08-2015	0.00	1.40	0.05	2132	1818	90.90	6.74	84.16
29-08-2015	0.00	1.34	0.06	2041	1640	98.40	5.40	93.00
30-08-2015	0.00	1.29	0.05	1966	1516	75.80	5.09	70.71
31-08-2015	0.00	1.21	0.08	1587	1422	113.76	4.38	109.38
01-09-2015	0.00	1.16	0.05	1422	1363	68.15	3.24	64.91
02-09-2015	55.00	2.00	0.04	4235	2722	108.88	6.29	102.59
03-09-2015	0.00	1.95	0.05	4129	2654	132.70	7.06	125.64
04-09-2015	0.00	1.90	0.05	4023	2587	129.35	7.06	122.29
05-09-2015	0.00	1.84	0.06	3896	2436	146.16	6.99	139.17
06-09-2015	0.00	1.78	0.06	3288	2336	140.16	6.70	133.46
07-09-2015	0.00	1.72	0.06	3204	2277	136.62	6.38	130.24
08-09-2015	0.00	1.67	0.05	3111	2211	110.55	6.66	103.89
09-09-2015	0.00	1.62	0.05	3018	2145	107.25	6.46	100.79
10-09-2015	0.00	1.56	0.06	2379	1989	119.34	5.29	114.05
11-09-2015	0.00	1.51	0.05	2300	1926	96.30	5.12	91.18
12-09-2015	0.00	1.47	0.04	2248	1885	75.40	5.54	69.86
13-09-2015	0.00	1.42	0.05	2163	1880	94.00	7.24	86.76
14-09-2015	0.00	1.38	0.04	2102	1758	70.32	6.52	63.80
15-09-2015	0.00	1.32	0.06	2011	1650	99.00	5.54	93.46
16-09-2015	0.00	1.27	0.05	1935	1492	74.60	6.16	68.44
17-09-2015	0.00	1.23	0.04	1615	1442	57.68	6.46	51.22
18-09-2015	8.00	1.20	0.03	1575	1410	42.30	4.24	38.06
19-09-2015	17.20	1.50	0.04	2284	1911	76.44	2.27	74.17
20-09-2015	0.00	1.46	0.04	2222	1884	75.36	1.32	74.04
21-09-2015	0.00	1.41	0.05	2148	1850	92.50	1.30	91.21
22-09-2015	3.60	1.37	0.04	2087	1745	69.80	2.57	67.23
23-09-2015	0.00	1.32	0.05	2011	1650	82.50	5.08	77.42
24-09-2015	0.00	1.28	0.04	1951	1505	60.20	4.21	55.99
25-09-2015	0.00	1.22	0.06	1601	1433	85.98	4.21	81.77
26-09-2015	0.00	1.18	0.04	1550	1387	55.48	3.98	51.50
27-09-2015	0.00	1.13	0.05	1482	1328	66.40	3.53	62.87
28-09-2015	0.00	1.08	0.05	1416	1238	61.90	3.99	57.91
29-09-2015	17.00	1.40	0.04	2132	1818	72.72	5.73	66.99
30-09-2015	0.00	1.36	0.04	2072	1715	68.60	5.40	63.20
01-10-2015	0.00	1.32	0.04	2011	1650	66.00	5.08	60.92
02-10-2015	0.00	1.28	0.04	1951	1505	60.20	5.37	54.83
03-10-2015	0.00	1.22	0.06	1601	1433	85.98	5.52	80.46
04-10-2015	0.00	1.18	0.04	1550	1387	55.48	5.83	49.65
05-10-2015	0.00	1.13	0.05	1482	1328	66.40	4.83	61.57
06-10-2015	0.00	1.08	0.05	1416	1238	61.90	5.11	56.79
07-10-2015	0.00	1.02	0.06	1013	1168	70.08	4.25	65.83

Date	Rainfall (mm)	Water Level (m)	Depletion/ Addition (m)	Volume of Storage (m ³)	Surface Area (m ²)	Volume of Depletion (m ³)	Volume of Actual Evaporation (m ³)	Net Recharge (m ³)
08-10-2015	0.00	0.97	0.05	963	1112	55.60	4.28	51.32
09-10-2015	0.00	0.93	0.04	923	1066	42.64	3.95	38.69
10-10-2015	0.00	0.87	0.06	864	997	59.82	3.14	56.68
11-10-2015	0.00	0.81	0.06	804	917	55.02	3.72	51.30
12-10-2015	0.00	0.77	0.04	735	742	29.68	2.55	27.13
13-10-2015	0.00	0.72	0.05	560	610	30.50	2.09	28.41
14-10-2015	0.00	0.65	0.07	539	469	32.83	1.41	31.42
15-10-2015	0.00	0.60	0.05	275	432	21.60	1.24	20.36
16-10-2015	0.00	0.54	0.06	256	358	21.48	1.28	20.20
17-10-2015	0.00	0.48	0.06	240	288	17.28	1.03	16.25
18-10-2015	0.00	0.41	0.07	205	246	17.22	0.91	16.31
19-10-2015	0.00	0.34	0.07	170	204	14.28	0.81	13.47
20-10-2015	0.00	0.27	0.07	135	162	11.34	0.64	10.70
21-10-2015	0.00	0.20	0.07	100	120	8.40	0.36	8.04
22-10-2015	0.00	0.13	0.07	84	78	5.46	0.21	5.25
23-10-2015	0.00	0.06	0.07	48	40	2.80	0.12	2.68
24-10-2015	0.00	0.00	0.07	0	0	0.00	0.00	0.00
25-10-2015	0.00	0.00	0.00	0	0	0.00	0.00	0.00
Total	455.10					8314.50	412.22	7902.28

Annexure 7.1: Social Management Plan under RACP (Implementation strategy of Ladnun cluster)

Component 1: Climate resilient agriculture

A. Improvement of water use efficiency

SL	Major Activity	Sub Activity	Social Risk	Mitigation	Process	Out come	Responsible for Implementation (cluster level)
1	Watershed	Construction of tankas, Pakki Nadi (Johad) , Pasture development activity as per CACP Ladnun cluster	<ul style="list-style-type: none"> • Inequity in the use and distribution of water. • The risk of conflicts among water users resulting from collective efforts at establishing more efficient water usage 	<ul style="list-style-type: none"> • Exposure visits of farmers to water scarce areas use of water to more managed and equitable resource-sharing arrangement. • Close monitoring of water use and distribution arrangements by CBOs, CRPs and F-NGO. • Identification of women-owner farmers, and their prioritized inclusion in all project benefits. • %age of small and marginal 	<ul style="list-style-type: none"> • Equal in the use and distribution of water in small and marginal farmer through user group. • In reference of social management plan, suggest that small and marginal farmers, tribal farmers, SC and women farmer will be target preferred according categories percentage in 	<ul style="list-style-type: none"> • Increase in gross area under cultivation, with resultant rise in crop production and farm incomes. • Availability of on-farm wage labor opportunities to women and men. • Decline in seasonal and daily migration 	Line Department & F NGO team

			<p>norms.</p> <ul style="list-style-type: none"> The risk of exclusion of women and marginal/small farmers from project investments and other benefits 	<p>farmers receiving the project benefits (in terms of numbers and investments) will be – to be monitored through PMIS</p>	<p>Ladnun Cluster.</p> <ul style="list-style-type: none"> Consultation held including small and marginal farmer with vulnerable group. Farmer selection process through MTG discussion 	<p>rates in project areas.</p>	
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B. Technology transfer and market-led advisory services

S L	Major Activity	Sub Activity	Risk	Mitigation	Process	Out come	Responsible for Implementation -on (cluster level)
1.	Agriculture	<ul style="list-style-type: none"> Micro Irrigation (drip irrigation/ mini sprinkler) Water harvesting/ Storage Structure (Diggies) in Command area Soil testing Demonstrations on production technologies Demonstrations on farm mechanization and PHM technologies Demonstrations on forage/ 	<ul style="list-style-type: none"> Risk of marginal and small farmers; increased food insecurity Risk of resource-poor smallholder farmers being further indebted to moneylenders Increased perishability, and challenges in marketability of produce (thus risking income) Risk of livelihood security 	<ul style="list-style-type: none"> Facilitate for market oriented agriculture comprising high-value and high-risk crops. Promote establishment of grain banks with exclusive membership of marginal and small farmers. Promote nutritional security through a kitchen garden component. Relaxation of contribution norms in the case of smallholder farmers (to be decided by the village institution on a case-by-case basis). Established market linkages before start of production. Strengthen farmers' organizations for taking up collective marketing 	<ul style="list-style-type: none"> In reference of social management plan, suggest that small and marginal farmers, tribal farmers, SC and women farmer will be target preferred according categories percentage Ladnun Cluster. Social baseline information. Consultation held including small and marginal farmer with vulnerable group. Farmer selection process through MTG discussion 	<ul style="list-style-type: none"> Increase in farm production and productivity as a result of improved seed management and cultivation practices. Ensure that beneficiary should be member of MTGs. Cluster's all community will be benefited 	Line Department & F NGO team

		<ul style="list-style-type: none"> fodder Seed Production 					
2.	Horticulture	<ul style="list-style-type: none"> Demonstrations on production technologies for Fruit Cultivation Demonstrations on production technologies for vegetable Cultivation Assistance on Greenhouse/shade net house cultivation Solar pump set including fencing, auto tracker (One set per farmer) Post-Harvest Management Horticulture Mechanization 	<ul style="list-style-type: none"> Risk of marginal and small farmers; increased food insecurity Risk of resource-poor smallholder farmers being further indebted to moneylenders Increased perishability, and challenges in marketability of produce (thus risking income) Risk of livelihood security 	<ul style="list-style-type: none"> Promote local-level semi-processing and value-addition Capacitate farmers in value-addition techniques Integrated Farming Systems Approach especially for Dry-land Agriculture Integration of crop farming with horticulture, animal husbandry, back-yard poultry, and agro-forestry Capacitate farmers in value-addition techniques Integrated Farming Systems Approach especially for Dry-land Agriculture Integration of crop farming with horticulture, animal husbandry, back-yard poultry, and agro-forestry 	<ul style="list-style-type: none"> In reference of social management plan, suggest that small and marginal farmers, tribal farmers, SC and women farmer will be target preferred according Categories percentage. Social baseline information. Consultation held including small and marginal farmer with vulnerable group. Farmer selection process through MTG discussion 	<ul style="list-style-type: none"> Market-led advisory services will result in reduced losses, greater access of farmers to markets and financial institutions and higher incomes. Ensure that beneficiary should be member of MTGs. Cluster's all community will be benefited 	Line Department & F NGO team

C. Livestock strengthening and management

SL	Major Activity	Sub Activity	Social Risk	Mitigation	Process	Out come	Responsible for Implementation (cluster level)
1	Animal Husbandry	<ul style="list-style-type: none"> Buck Distribution Goat distribution to Widows and/or 	<ul style="list-style-type: none"> The risk of migrant households, particularly shepherds, getting excluded from receiving the benefit 	<ul style="list-style-type: none"> Allow medical supplies (deworming and routine vaccination) for migrant herds to be given in bulk for the duration away from the village. Develop a cadre of women CRPs in different thematic areas, including 	<ul style="list-style-type: none"> In reference of social management plan, suggest that small and marginal farmers, tribal farmers, SC and 	<ul style="list-style-type: none"> All farmers with goats will stand to benefit from project interventions under the 	Line Department & F NGO team

		<p>especially abled women</p> <ul style="list-style-type: none"> • Health and Awareness camps • Fodder Demonstrations on private lands • Azolla Demonstration • Lady Link Worker cum Marketing Facilitator • Housing and Management • Chaff Cutter Distribution 	<ul style="list-style-type: none"> • The risk of women being excluded from training and related activities • The risk of Pastureland development • Displacement – if there are any temporary houses on it • Affect access to the land for grazing/ stalling livestock 	<p>animal husbandry.</p> <ul style="list-style-type: none"> • Development of pasturelands to be preceded by consultations with all resource users. • Follow the principles and procedures outlined in the RPF in case of impact on house/ livelihood. • Formation of common land user associations/ resource institutions for development and management of the resource. • F-NGO will facilitate consensus building for arriving at and implementing equitable use and cost-benefit sharing norms. 	<p>women farmer will be target preferred according Categories percentage.</p> <ul style="list-style-type: none"> • Social baseline information. • Consultation held including small and marginal farmer with vulnerable group. • Beneficiary selection criteria 	<p>livestock component.</p> <ul style="list-style-type: none"> • The overall impact of these interventions will be a rise in income from goat rearing. • Cluster's all community will be benefited 	
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Component 2: Markets and value chains

SL	Major Activity	Sub Activity	Social Risk	Mitigation	Process	Out come	Responsible for Implementation (cluster level)
1	Markets and value chains	<ul style="list-style-type: none"> • Agri-Business Promotion Facility (ABPF) • Pre-Investment Advisory Support • Market Infrastructure and Agribusiness 	<ul style="list-style-type: none"> • It is expected that sufficient land would be available with the Gram Panchayat for establishment and/or construction of common use facilities proposed under the project, • Loss of control of 	<ul style="list-style-type: none"> • Land-based interventions would be located only in those areas where such land is readily available and voluntarily offered by the Gram Panchayat. • The procedure for obtaining a “no objection certificate” from the Gram Panchayat is specified in the RAP. A screening format for all land-based interventions is also appended. • Form and strengthen exclusive 	<ul style="list-style-type: none"> • The project will provide technical assistance to farmer groups, producer organizations, processors, input suppliers and other value chain participants. • In reference of social 	<ul style="list-style-type: none"> • Higher income from market-oriented agriculture and market advisory services is the expected outcome of this component. • Formation of producers' companies will 	Line Department & F NGO team

		Support	women over farm production with commercialization -on and formalization of markets – further disempowerment of women in the household economy	women farmers' groups for collective enterprise development. <ul style="list-style-type: none"> • Co-additional women farmers in producer companies if there are not enough women in the company. 	management plan , suggest that small and marginal farmers, tribal farmers, SC and women farmer will be target preferred according Categories percentage.	lead to an increase in farmers' bargaining capacity and help in collective procurement of quality agriculture inputs.	
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Component 3: Farmers' organization and capacity building

#	Major Activity	Sub Activity	Social Risk	Mitigation	Process	Out come	Responsible for Implementation (cluster level)
1	Farmers' organization and capacity building	<ul style="list-style-type: none"> • capacity building • Socio economic Data collection • Identification of Targeting and Beneficiary • MTGs (Multi Task Groups) • MTA (Multi Task Association) • FPC (Farmer Producer Company) • Training on Social 	<ul style="list-style-type: none"> • Risk of exclusion of women from benefits of training for technological interventions. • Risk of exclusion of smallholder farmers. • Women are not recognized as farmers in their own right. 	<ul style="list-style-type: none"> • Develop a cadre of women CRPs, cascade training approach for capacity building of women farmers. • Equal participation of women in RACP processes and institutions. Equitable distribution of project benefits between women and men, as outlined in the gender and women empowerment strategy. • Equitable participation of smallholder farmers in RACP processes and institutions. • Customization of project interventions to meet the requirements of smallholders. • Relaxation and flexibility in cost-sharing norms and/or repayment terms for small holders, to be decided by the local member institutions. 	<ul style="list-style-type: none"> • Arrange rally, Arrange Nukkar, Natak, group meeting, PRA (Participatory Rural Appraisal) exercise, and Information, Education and Communication (IEC) activities. • Poster, Pamphlets Literature related to RACP Project. • Wall painting of RACP slogan. • Data collection will enumerate all household within the clusters. • MTG will comprise of 15-20 nearest/vicinity field land holders. • MTA will comprise of 11 member from MTGs member in watershed cluster. • FPC will comprise all MTGs member through shareholding. • Consultation held including small and marginal farmer with 	<ul style="list-style-type: none"> • Community will aware about RACP Project. • Ensuring community participation. • Project goal be achieved. • Analyses the findings by different socio-economic groups. • Cluster's all community will be benefited 	Community Mobilization specialist & F NGO team

		managemen t Plan		<ul style="list-style-type: none"> • Strengthening of farmer organizations for the use and management of water to precede other interventions. 	<ul style="list-style-type: none"> • vulnerable group. • Farmer selection process through MTG discussion 		
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Annexure 7.2 Environment Management Plan (EMP)

The key interventions under RACP can be grouped as under:-

- Crop intensification
- Water Management
- Livestock Management
- Value chain development activities

Environment Management Plan for Crop Intensification

The key objective of interventions in crop production is to increase crop productivity so that farmer income is also enhanced. The dominant and “business-as-usual” approach to achieving this is to intensify crop production by introducing hybrid seed varieties that respond well to chemical fertilizers and apply chemical pesticides to control pests and diseases that attack the crop. However, use of such intense chemical based crop production technologies results in the long-run in decreased yield. Increased use of chemical pesticides leads to destruction of pest predators and increase in pest and diseases. Most, hybrid seeds are designed to respond to higher doses of chemical fertilizers and do not perform well if they are not provided.

Thus, if a “business-as-usual” approach is taken to increasing crop productivity under RACP, there is a high likelihood of use of agri-chemicals increasing substantially leading to deterioration of soil quality which would reduce crop productivity and thereby agricultural competitiveness in the long run. Further, these agri-chemicals would pollute the village ecosystem and affect the health of the farming families in the village and their livestock as well.

The RACP proposes to adopt “green” agricultural practices that would promote Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) and therefore, the possibility of excessive use of agri-chemicals is largely mitigated.

It is defined as producing more from the same area of land while reducing negative environmental impacts and increasing contributions to natural capital and the flow of environmental services. Sustainable Crop Production Intensification (SCPI) views farming as an ecosystem which uses inputs, such as land, water, seed and fertilizer, to complement the natural processes that support plant growth, including pollination, natural predation for pest control, and the action of soil biota that allows plants to access nutrients.

The Line Department /NGO will abide by the Environmental measures listed in the Environment Management Plan (EMP) given below. The Line Department shall include the EMP requirements in the Programme of RACP Works. The requirements stated in the EMP should therefore be studied properly and implemented accordingly.

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Impact on Environment	Possible Environmental Impacts	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
Demonstration packing of practices for higher production of selected crops	Crop Selection	Low	Selected crop may lead to consumption of more water	The sustainable availability of water and crop water requirement of each crop that is suited to the agro-climatic conditions of the cluster and choosing only those crops that can be grown within the available water. This assessment has to be conducted at the sub-watershed level for rained areas, at the aquifer level for groundwater conditions.	Design of package practices	% of farmers got aware that crops have been selected based on water availability. % of crops that are water efficient (50%)	% of farmers following crops recommended based on water availability
			Selected cropping pattern may lead to nutrient depletion	Cropping pattern should be chosen such that the same crop is not being grown in the same patch of land season after season, year after year. Crops should be rotated to ensure that crops with different root zones, different demands on nutrients and different pests and diseases are grown. This would help in better soil, nutrient and pest management.		% of farmers got aware that identified cropping pattern based on crop rotation.	% of farmers following recommended cropping pattern
	Seed Selection		Variety may not be suited to the area or preferred by the farmers	Well adapted, high-yielding varieties with resistance to biotic and a -biotic stresses and improved nutritional quality should be chosen to mitigate risks of crop.	Design of Package of Practices & at the time of purchase of seeds for distribution.	% of farmers got awareness on the varieties that are suitable to the local conditions.	% of Farmers using the varieties suitable for the region
	Seed selected may be pest or disease infected		Use of seeds of good quality that are pests & disease free determines crop performance to a	% of farmers has access to certified seed.			

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Impact on Environment	Possible Environmental Impacts	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
			leading to pest attack and crop loss or increased use of chemical pesticides	large extent. Therefore, Seeds when purchased should be only from certified sources and should be used well within the expiry date.			
			Genetically modified seeds may be used that are not approved for use in Rajasthan	In case of selection of Genetic Modified varieties guidance should be sought from the Department of Agriculture on whether it is an approved variety in the state or not.			
	Soil Health & Nutrient Management		Degradation of soil physical characteristics due to intensive cropping	Nutrient management is based on Integrated Nutrient Management Plan (INM). Package of practices considering the soil nutrient status of the cluster	Design of Package of Practices & at the time of purchase of fertilizers including biofertilizers for distribution.	% of farmers got aware on Integrated Nutrient Management practices. % of farmers who have been issued Soil Health Cards % of farmers who have received Soil Test results before taking up cropping	% of farmers who are applying fertilizers as per dosage recommended by the Soil Test result % reduction in use of chemical fertilizers over baseline in kg/Ha.
			Deterioration of nutrient content of soil due to intensive cropping				
			Increased and imbalanced use of chemical fertilizers				
	Pest & Disease Management		Increased chemical pesticide use	Restricting the use of banned pesticides (as per WHO, list) and promoting the Integrated Pest management Plan (IPM).	Design of Package of Practices & at the time of purchase of pesticides including biopesticides /	% of farmers who have attended training/demonstration on IPM	% of farmers who have adopted all components of IPM. % reduction in use of chemical pesticides over baseline in l/Ha.
			Increased incidence of pests if the same crop is promoted				

Intervention	Activity	Multiple Sectors				Monitoring Indicators	
		Impact on Environment	Possible Environmental Impacts	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
			repeatedly Safety issues in storing and using chemical pesticides		bio-control agents /pheromone traps for distribution.		
	Demand-side Water Management		Introduction of micro irrigation devices may lead to expansion of cropped area leading to no net reduction in water used in agriculture sector Cropping pattern may be leading to unsustainable use of available water	The key practices to be adopted at the design stage itself are: <ul style="list-style-type: none"> ➤ Compulsory use of micro irrigation to irrigate crops in all water regimes so as to reduce absolute quantity of water applied and also increase water use efficiency ➤ Simple low pressure, gravity fed drip systems could be used in such situations to reduce the capital cost to the beneficiary. ➤ Mulching is an important operation to be carried out for weed control as well as improve water use. 	At the time of design of cropping plan in CACP As a process during implementation of water management plan	% of farmer who have attended training on water conservation.	% of farmer who have adopted micro irrigation and drip system. % of farmer who have carried out mulching practices.
	Storage & Handling of Agri-inputs		Poor storage, handling can lead to spills and leaks of fertilizers and pesticides leading to contamination of soil and water	The following precautionary principles shall be followed an existing storage facility: <ul style="list-style-type: none"> ➤ Bagged fertilizer must be handled in a manner to prevent fertilizer from escaping to the environment. 	Design of Package of Practices & at the time of purchase of seeds, fertilizer, pesticides for distribution.	% of farmers who have attended training on precautions mentioned in measures to be taken/Implemented for storage and Handling of agri-inputs.	% of farmers followed code of practices for storage and handling agri-inputs.

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Impact on Environment	Possible Environmental Impacts	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				<ul style="list-style-type: none"> ➤ Spills should be cleaned up immediately to avoid the potential for soil and groundwater contamination. 			
			Poor storage may lead to pest and disease infestation of seeds	Seeds should be stored in air tight containers and away from sunlight, heat and moisture. Before storage, the moisture level of the seeds should be brought down to an appropriate level by drying it in sunlight followed by drying in shade. Seeds of different should be stored in separate containers and clearly labeled.			

Environment Management Plan for Water Management

Water harvesting and water management activities are expected to be implemented in the RACP, namely, rain fed, groundwater based and surface water based. The main objectives are to harvest and store water in rain fed systems, harvest and recharge in groundwater systems and under all water regimes to sustainably use water for cropping and livestock, reduce use of water in agriculture sector and increase water-use efficiency in cropping.

Climate variability and emerging climate change in semi-arid areas in India pose considerable threat to the natural resources that sustain fodder production for livestock. Pasture lands, in absence of appropriate management practices, are at risk of further degradation with precipitation expected to occur in future, in more concentrated rainfall events interrupted by longer dry spells. Loss of grazing lands may result in more intensive management practices, increasing competition between land for food grain cultivation and livestock activities, or decreasing livestock populations, under mining the security function that livestock rearing provides.

Overall, activities under this subcomponent are expected to reduce absolute quantity of water use in agriculture while increasing water-use efficiency. Therefore, environmental impacts are expected to be positive.

The Line Department /NGO will abide by the Environmental measures listed in the Environment Management Plan (EMP) given below. The Line Department shall include the EMP requirements in the Programme of RACP Works. The requirements stated in the EMP should therefore be studied properly and implemented accordingly.

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
Water Supply Augmentation	Water Harvesting Recharge & Storage Structures:- Tanka, Nadi and Pastureland Development	Top soil removal	Medium	Soil removed during the process of digging water harvesting storage structures should be used to build bunds and top soil should be spread over the rest of the farm.	At the time of CACP. At the time of sanction of individual structure for implementation	% of trees actually planted as compared to number of trees to be taken up under compensatory planting. % Water harvest structure with vegetative cover to prevent erosion and siltation. % Water harvest structures with safety provisions.	% survival of trees planted under compensatory planting. % of water harvest structure designed and constructed on the basis of catchment area, rainfall pattern, Physiographic condition and water demand and followed safety measures. % of water harvest & Storage structures properly designed and constructed to ensure that not more than 70 % of total runoff from drained area. % of pastureland developed.
		Cutting of trees		As far as possible, these structures should be sited where there are no trees. If tree cutting is unavoidable, then compensatory planting in the ratio of 1:10 should be carried out and the beneficiary group made responsible for maintaining it with at least 90% survival till 3 years. Plant species should be grown for pastureland development and Water harvesting structures as following:- Tree species : Acacia albida, Albizia lebbek, Azadirachta indica, Prosopis cineraria, Zizyphus mauritiana, Acacia senegal, Acacia tortilis, . Shrubs Capparis decidua, Zizyphus sp., Balanites aegyptica, Calligonum polygonoides, etc. Grasses and legumes : Lasiurus sindicus, Cenchrus ciliaris, Cenchrus setigerus, Stylosanthes scabra, Panicum antidotale, Chloris			

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				<p>gayana. Desmodium trifolium, Macroptelium atroperepureum, etc.</p> <p>The basic requirement for pastureland management should be balanced the number of grazing animals (livestock) with grazing capacity (Carrying capacity) and rotational grazing. Not more than 80% of the range resource should be utilized.</p> <ul style="list-style-type: none"> Fencing should be conventionally used for closing the area and protecting it from biotic interference. 			
		Siltation, seepage & erosion of Water harvest & storage structures		<p>Following measures should be confirmed to standard design, safety and maintenance for water harvest & storage structure.</p> <p>Standard design for these storage structures should be related to the size of the plot on which the storage structures are to be sited and quantity of runoff expected. Thus, size of storage structures can be expressed as a percentage of the plot area for a given range of runoff.</p> <p>Water should be passed through a silt filter to prevent frequent silting up to these storage structures.</p> <p>Reduction in the seepage rate may</p>			

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				<p>be achieved by mixing swelling clay material such as bentonite with soil.</p> <p>Bunds should be covered with vegetative cover to ensure longevity with lower maintenance costs. Grasses such as Lasiurus sindicus, Cenchrus ciliaris, Cenchrus setigerus, Stylosanthes scabra, Panicum antidotale, Chloris gayana. Desmodium trifolium, Macroptelium atropurpureum, Vetiveria zizanioides, Saccharum munja etc. could be grown to help bind the soil together and thereby stabilize the bund.</p>			
		<p>Too many water harvesting structures may affect downstream flows</p> <ul style="list-style-type: none"> • With ground water getting recharged more bore wells are dug and more water is extracted. 		<p>The focus of the project is to transfer knowledge and skills to organized groups of farmers on understanding, addressing the groundwater situation and its sustainable use.</p> <ul style="list-style-type: none"> • Where a no. of Nadi and tanka are being constructed, care shall be taken to ensure that not more than 70% of total runoff from the drained area is being stored. This is to ensure that there is adequate flow to meet downstream economic and ecological services. • Shifting to crops with lower water demand if available water is not sufficient 			

Intervention	Activity	Multiple Sectors				Monitoring Indicators	
		Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				<ul style="list-style-type: none"> • Compulsory use of micro irrigation to irrigate crops in all water regimes so as to reduce absolute quantity of water applied and also increase water use efficiency 			
		<i>Alienation of pasture land for purpose other than grazing</i>		The RACP shall adopt a simple resolution stating that it shall not use public pasture land for any purposes other than for pasture development and/or constructing water harvesting, recharge and storage structures with a view to benefiting the development of the pasture. Further, it shall not accept any pasture land provided by any authority for any purpose other than those mentioned above.			

Environment Management Plan for Livestock Management activities

RACP has recognized the importance of livestock in ensuring nutrient recycling in cropping systems. Accordingly, it has included a component that focuses on improving livestock management, especially for goats. The key environmental impact of this activity would be shortage of fodder and increased grazing pressure on existing pastures.

Further, the project proposes to provide health care through organizing Animal Health Camps and also by providing permanent services through a Rural Technology Centre-cum-Animal Health Centre. The likely impacts of these are issues related to safe disposal of syringes, needles and vaccines used in treating the animals.

Therefore, there is a need to develop pasture (tree & grasses) lands on common and private land, bring in improved feed practices such as using chaff cutters to ensure that there is no rejection of fodder by the animals, use of mineral supplements to increase productivity, inclusion of fodder crops in the cropping pattern to ensure year-round feed and fodder availability etc. Of these, for small ruminants, development of pastures is the most important intervention since they need both tree leaves as well as grasses. Further, since small ruminants are almost entirely free grazed, availability of well-developed pastures is very essential.

The Line Department /NGO will abide by the Environmental measures listed in the Environment Management Plan (EMP) given below. The Line Department shall include the EMP requirements in the Programme of RACP Works. The requirements stated in the EMP should therefore be studied properly and implemented accordingly.

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
Livestock Development & Management	Breed improvement of goats through introduction of bucks	Breed may not be suited to the area	Low	<ul style="list-style-type: none"> • Good quality bucks of the chosen breed (ensure that the breed being promoted complies with The Rajasthan Livestock Improvement Act No.45 of 1958) born in twins and triplets should be selected as breeding bucks. A buck is generally sufficient to serve about 30-40 females. • Bucks kept with a goat rearer group should be exchanged with other similar groups after 10-12 months to avoid inbreeding. 	At the time of CACP. At the time of preparation of the Livestock Management Plan	Ratio of elite bucks of chosen breed to no. of females in a herd/goat rearers group.	% of herd showing full characteristics of chosen breed.
		Fodder may not be sufficient to support the herd		<ul style="list-style-type: none"> • Development of community pasture land goes hand in hand with herd improvement. Planting tree species such as Gliricidia, Prosopis cineraria, Acacia, etc. on field bunds, backyards and on bunds of pasture lands would help in meeting the fodder requirements of goats. 		% of nondescript and mixed breed kids castrated to total kid population.	

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				<ul style="list-style-type: none"> Kids should also be given very succulent green fodder such as maize, Lucerne, etc. If adult goats are completely stall fed they should be given a daily feed of <ul style="list-style-type: none"> Green fodder – 3to 4 kg Dry fodder - 1 to 2 kg Readymade concentrate – 200-250 g If they are partly stall fed and partly free grazed they may be given half these rations. 			
	Animal Health Inputs	Disposal of Used and expired vaccines and Biomedical waste		Biomedical wastes including needles, syringes, vaccines, medicines etc. generated from conducting animals health camps should be disposed of after treating 10% Sodium Hypochlorite solution then before burying them in deep pits which are at least 500	At the time of CACP. At the time of preparation of the Livestock Management Plan	% of staff who have attended training on Biomedical Waste Management for animal health camps	% of animal health camps that have adopted safe disposal of medical wastes % Animal Health Camp sites that have a safe disposal pit

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				m away from water bodies, grazing land and other human habitations. These pits should be covered with soil immediately after disposal of the wastes.		% of farmers who received awareness on banned medicines and ill effects of antibiotics and growth promoters.	
		Use of banned veterinary medicines Use of antibiotics as growth promoters (eg: tylosin, quinolone, tetracycline, gentamicin, amantadine) may lead to side effects on human health		Diclofenac and its formulations (for animal use) are prohibited for manufacture and sale through GSR NO. 499(E) Dated 04.07.2008 under section 26 A of Drugs & Cosmetics Act 1940 by The Ministry of Health and Family Welfare, India Use of antibiotics and growth promoters should be strictly prohibited.			
	Goat shade and Manure Management	Congested and improperly maintained sheds may result in quick outbreak of diseases. If improperly managed, manure and shad can be a		The sheds must have enough space and ventilation equipped with feed and water troughs and facilities for manure and urine collection.. Livestock owners must take responsibility for the manure generated by their animals in	At the time of CACP. At the time of preparation of the Livestock Management Plan	% of goat herd owner has aware shade and manure management.	% of goat herd owner adopted shade and manure management

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
		source of water pollution, odor, flies, parasites, and other nuisances. It can contaminate drinking water and harm goat.		order to prevent water pollution. Composting is a controlled and managed aerobic (“with air”) decomposition process for manure and other organic materials waste.			

Environment Management Plan for value chain activities

Storage and processing of produce are activities expected to be taken up under value chain development component of the RACP.

The operations include input supply to its members, output marketing and processing support to its members, providing warehousing facility, etc. These activities when carried out in a “business-as-usual” manner would affect the environment in one way or the other. For example, if the Farmer Producer Organization (FPC) were to promote agri chemicals indiscriminately, as a pesticides dealer would, it would result in increased use of such chemicals in the project area. Therefore, there is a need for the FPC to operate as a responsible business entity.

All of food processing units consume huge amount of water for processing food. A considerable part of these waters are potential wastewaters to be treated for safe disposal to the environment. Wastewater and solid waste are the primary waste streams for the food processing units.

The Line Department /NGO/ Design consultants/engineers hired for designing and executing the structures will abide by the Environmental measures listed in the Environment Management Plan (EMP) given below. The Line Department shall include the EMP requirements in the Programme of RACP Works. The requirements stated in the EMP should therefore be studied properly and implemented accordingly.

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
Value Chain Development	Farmer Producer Organization (FPO)	FPO activities may promote increased use of agri chemicals	Medium	Unlike a general agri-input merchant, the FPO shall not stock, sell and promote agri-chemicals. pesticides banned/restricted as per WHO classification. indiscriminately. It shall make strong efforts to ensure that its members follow IPM and INM and accordingly shall stock and sell inputs relevant to implementing INM and IPM.	At the time of preparation of the business plan of the FPC.	% FPCs trained on Code of Practices for value chain	% FPCs with a CoP developed and adopted by the BoD.
	Establishing Food Processing Units	Water pollution ,air pollution , noise pollution and Solid waste may be generated through food processing Units Use of plastic for packaging may lead to issue of solid waste disposal. Exposure to noise and dust pollution may result in occupational health hazards among the workers.		<ul style="list-style-type: none"> Water used in conveying materials, facility cleanup, or other non-ingredient uses will be reduced, which in turn will reduce the wastewater volume from food-processing facilities. Sanitizers or anti-microbials in wash water and other processing water may be useful in reducing pathogens on the surface of produce and/or reducing pathogen build-up in water. Chlorine is a commonly used anti-microbial. Typically, pathogens, suspended solids, dissolved solids, nitrogen, and phosphorus are removed in advanced wastewater treatment. The following is a listing of some technologies being used in advanced wastewater treatment. A .Membrane applications 		% of workers of food processing Units are aware waste water and solid waste management practices.	% of food processing units are adopted waste water treatment and solid waste management practices.

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
		Use of energy from renewable sources will encourage high emissions.		<p>B. Charge separation etc.</p> <ul style="list-style-type: none"> • Food processing units will continue to look at ways to reduce solid waste generation, use less or reusable packaging, and use biodegradable packing products. • Solid waste pollution can be reduce through management alternatives as following: A. Using the food by-product as an animal feed. B. Composting or land spreading the food by-product. • Noise protective equipment should be provided to the operator of machines. Silencer should be attached to the equipment to reduce noise from the equipment to surrounding areas. • First aid kit should be available in each processing unit that involves use of machinery. • Use energy efficient equipment for processing (such as steam boilers). 			

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
	Construction of Warehouse/ Food processing Unit	Cutting trees		As far possible, RACP would promote options wherein trees would not be cut to carry out an activity. However, where it is not feasible it would support compensatory planting in the ratio of 10 trees for every tree cut. The onus on planting will lie with the beneficiary who is cutting the trees.	At the time of CACP	% of trees actually planted as compared to no. of trees to be taken up under compensatory planting. % of construction workers who have detailed mitigation measures for building construction.	% survival of trees planted under compensatory planting. % of construction workers adopted EMP for building construction.
		Top soil removal		Top soil removed during the process should be used to build bunds and excess soil should be spread over the rest of the farm.	At the time of design and approval of building plans.		
		Improper construction leading to damage of stored material		In addition to the above general guidance on building constructions, the RACP shall adhere to Code of Practice for Construction of Food grains Storage Structures as defined under the Warehouse Manual published by the Department of Food & Public Distribution, Ministry of Food & Consumer Affairs, Govt of India under operationalization of the Warehousing (Development & Regulation) Act, 2007.			
		Environment pollution may be generated During construction		<ul style="list-style-type: none"> The sewage system for the labour/ camp is designed, built and operated in such a manner that no health hazard 			

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
		activities.		<p>occurs and no pollution to the air, ground water or adjacent water sources takes place.</p> <ul style="list-style-type: none"> Waste water generated from the sanitary facilities of labour camp is disposed in a septic tank/soak pits. Solid waste generated at the construction site, plant/camp site, will be collected in covered wasted bins and segregated as biodegradable (food waste, paper, etc) and non-biodegradable (plastic, polyethylene bag etc.). Polyethylene/plastic wastes will be stored in empty cement bags and should be sent for recycling. Biodegradable (food waste, paper etc.) solid waste will be disposed in a compost pit. The contractor will take every precaution to reduce the level of dust and gaseous pollution from the work site/s. Measures to reduce the level of dust (PM 2.5 and PM 10) will be taken and the Contractor will make arrangements to minimize dust pollution through provision of wind screens/barriers, water sprinkling/mist fine spray arrangement and encapsulation of dust source (as required) shall be 			

Multiple Sectors						Monitoring Indicators	
Intervention	Activity	Possible Environmental Impacts	Impact on Environment	Measures to be Taken/Implemented by the Line Department	Stage of Application	Process	Outcome
				<p>made.</p> <ul style="list-style-type: none"> • Construction debris should be put to alternate uses such as land filling. If not utilized it should be disposed off in nearby safe places. • Only acoustic enclosures fitted DG set will be allowed at the construction and plant/camp sites. • All measures required for ensuring safety and health of the workers shall be taken up by the Contractor. This includes provision and enforcement of appropriate personal protective equipment; first aid facilities at camp, plant site and work zones; emergency response arrangements; proper storage of hazardous/ toxic and/or polluting materials; measures for ensuring electrical, fire and mechanical safety arrangements. • Energy conservation measure should be followed in constructed building like installation of solar energy, LED lighting etc as energy efficient building. 			

Clearance requirement

Agriculture and allied activities per se have not been incorporated under the ambit of the Environment Impact Assessment (EIA) notification 1994 so the project per se will not require any clearance under this act. The clearance requirements for individual subprojects have been specified in the table below.

Relevant Acts/Rules	Relevance to RACP Project	Provision
Air (Prevention and Control of Pollution) Act 1981	Applicable to, processing activities (dal mills, rice mills fish/ poultry feed manufacture etc.	Setting air quality standards, procedures for consent to operate enterprises, penalties etc. Consent should be taken to establish and operate.
The Water (Prevention and Control of Pollution) Act Amended: 1988	Applicable to any activities that release wastes into water bodies (eg: processing units etc.) The project will address the issue of Water contamination due to chemicals by adopting an IPM strategy.	Laying down the permissible limits/ standards of pollutants likely to be emitted, collection of samples of effluent and analysis and provisions for penalties.
The Biological Diversity Act, 2002 G.S.R.261 (E), [15/04/2004] - Biological Diversity Rules, 2004	The project envisages maintaining the biodiversity. At the same time the project will enhance crop productivity through sustainable natural resource management.	Regulation of access to biological diversity, empower National Biodiversity Authority and State Biodiversity Board to restrict certain activities that affect biodiversity adversely. Provision of appropriate legislation for declaration of Biodiversity Heritage sites at local level.
Scheduled Tribes and other Traditional Forest Dwellers (Recognition Forest Rights) Act, 2006	The Act determines the use rights for the collection Non Timber Forest Product (NTFP), agricultural operation, animal rearing and construction of common facilities.	Recognition of rights and responsibilities and authority for sustainable use, maintenance of ecological balance and strengthening the conservation regimen of forest while ensuring livelihood and food security.
Forest (Conservation) Act, 1980 (With Amendments made in 1988) Forest (Conservation) Rules, 2003 (With Amendments made in 2004)	Applicable to the project where agriculture or Any construction of common facilities are promoted near forest in tribal areas.	Reserved forest or any portion thereof, shall cease to be reserved. Forest land or any portion thereof may be used for any non-forest purpose. Necessary Clearance should be obtained from Forest Dept or Revenue Department for trees cutting and plantation..

Relevant Acts/Rules	Relevance to RACP Project	Provision
The Wild Life (Protection) Act, 1972	Applicable to the activities like livestock Development where grazing is involved in forest areas, collection of NTFP and construction of common facilities near forest areas.	Destruction, exploitation or removal of any wild life including forest produce from a sanctuary of the destruction or diversification of habitat of any wild animal, or the diversion, stoppage or enhancement of the flow of water into or outside the sanctuary is prohibited without a permit granted by the Chief Wildlife Warden.
The Insecticides Act. 1968 Amendment: Insecticides (Amendment) Act, 1977	Applicable to agricultural activities. Mitigation measures taken care in Pest Management Plan	Regulate the import, manufacture, sale, transport, distribution and use of insecticides with a view to prevent risk to human beings or animals, and for matters connected therewith.
The Fertilizer (Control) Order, 1985	Applicable to POs in cases where stocking and sale of fertilisers may happen	Registration is required for selling fertilizer at any place as wholesale dealer or retail dealer.
The Seeds Act 1966, The Seeds Rules 1968	Relevant to the project. The project does not envisage seed production yet, but will take cognizance of the act if promoted.	Regulation of sale of seeds of notified kinds or varieties. Determine the responsibilities for making and labelling. Certification agency and grant/ revoke of certificate, provision of penalties.
Bio-Medical Waste(Management & Handling) Rules, 1998	Rules will help in managing the waste generated by the veterinary health centres that may have adverse environment affects.	It shall be the duty of the every occupier of an institution generating bio medical waste which includes Veterinary institution and animal house to ensure-that such waste is handled without any adverse effect to the human health and the Environment.
Rajasthan Soil and Water Conservation Acts, 1964	Applicable to water harvesting & storage structures on arable and non-arable land	provide for the conservation and improvement of soil and water resources at cluster
Policies		
National Environment Policy 2006 Rajasthan State Environment Policy, 2010	The project promotes conservation and sustainable use of land, water and biomass which is one of the major challenges in agriculture sector. The project addresses the issue of awareness generation and mitigation measures	To protect and conserve critical ecological system and resources and to ensure equitable access to these resources for communities which are dependent on these resources for their livelihood.

Relevant Acts/Rules	Relevance to RACP Project	Provision
State Water Policy 2010 The Rajasthan Regulation and Control of The development and Management of Ground Water Bill, 2006	Optimization of water resources exploitation and raising the level of reliability of supplies through conjunctive use of surface and ground water.	Necessary permission should be obtained from ground water board or water resources department for extraction of water from ground water through for bore wall or canal for irrigation.
National Policy for Farmers 2007	The project envisages improvement of the land productivity and income of farmers in a sustainable manner.	To improve economic viability of farming by substantial increase in net income of the farmers, to conserve and regenerate land, water and genetic resources for sustainable improvement in productivity, profitability and stability of major farming system. To develop support services including provisions of timely input supply and agriculture credit at affordable interest rates to the farmers. Provide suitable risk management measures for adequate and timely compensation to the farmers.
State Policy for promotion of agro-Processing and Agri-business, 2010	The project envisages promotion of agro-processing industries and agri-business, thus, seeks to address the entire value chain in agro-processing and marketing, including development of the supply chain, market development and diversification.	To promote and encourage value addition and loss reduction in agriculture, including horticulture; introduce new post harvesting technologies; promote export of agriculture products produced and encourage the development of agro processing infrastructure and human resources.

Training Plan for Implementation of Environment Management Plan (EMP)

Apart from the training plan being presented here, every training provided under RACP should include where relevant a module on Environment Management Framework (EMF) and its application.

Objectives of training plan

The key objectives of the training plan are:

- To create awareness about RACP project activities and their environmental impacts.
- To create awareness about the Environmental Guidance that provides information on how to mitigate or avoid those impacts.
- To create awareness about the concept, approach and processes of EMF including selection of project activity, application of the specific Environment Guidelines (EGs), preparation of EMPs, monitoring performance of EMF and reporting.
- To teach how to apply the EMF and prepare EMPs for specific activities.

Training Type, Target Groups & Frequency

A 4-tier strategy for imparting training on the EMP is proposed and is presented **Error! Reference source not found.** :

Type of Training	Target Groups	Number of training	Frequency	Modes of training
Sensitization	<ul style="list-style-type: none"> • PMU • PIU • DPMU 	One	Launch of the Project	Lectures, Presentation
State Level Training (Training workshops for trainers)	<ul style="list-style-type: none"> • Environment Specialist (ES, PMU) • Line Department (Team Leader) • Field NGO (Team Leader) 	Two (Planned)	1st year at the beginning of the project	On-field demonstrations, Case Studies, Group Exercises.
State Level Training of Trainers (Demand Driven)			2nd Year a refresher course after preparation of Audit Report	
District Level training Workshops	<ul style="list-style-type: none"> • DPMU /DLIC • NGO (entire team) • Representatives of Cluster level /GP level / Village level Community Institutions • Representative of FPC including CEO 	One in each of the districts every year in district where there are interventions	1st year before interventions are initiated and thereafter each year after completion of audit.	Field Demonstrations, lectures, group discussions, case studies
Community Level Training Workshops	<ul style="list-style-type: none"> • All Community Institutions Leaders • FPC Board Members 	One in each of the districts every year in district where there are interventions	1st year before interventions are initiated and thereafter each year after completion of audit.	Field demonstration, group exercises, lectures

Tier-wise Suggested Training Content

Provides a brief outline of training content and duration for the 4 tiers of trainings envisaged. The actual content, pedagogy and duration should be developed as part of the general training being planned under RACP.

Type of Training	Content	Duration
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Type of Training	Content	Duration
Sensitization	Sensitization on RACP activities, environmental impacts Brief concept of EMP, Institutional arrangement for implementing EMP	2 hrs as a part of larger induction training at the launch of RACP
State Level Training (Training workshops for trainers)	Project activities and environmental impacts EMP to be presented thematically as Agriculture, Water Management, Livestock, Input Storage, etc. institutional arrangements for implementing EMP	3 days including 1 day of field visit to apply in EMP for sample project interventions
State Level ToT (Demand Driven)	Project activities and environmental impacts EMP to be presented thematically as Agriculture, Water Management, Livestock, Input Storage, etc. EMP process, institutional arrangements for implementing EMP	As per need
District Level training workshops	Project activities and environmental impacts EMP to be presented thematically as Agriculture, Water Management, Livestock, Input Storage, etc. EMP process, institutional arrangements for implementing EMP	5 days including 3 days for field visit to understand environmental issues and apply in EMP to understand IPM and INM in action. etc.
Community level training workshop	Project activities and environmental impacts EG to be presented thematically as Agriculture, Water Management, Livestock, Input Storage, etc. EMF process, institutional arrangements for implementing EMF	5 days including 3 days for field visit to understand environmental issues and apply in EMP to understand Integrated Pest Management (IPM) and Integrated Nutrient Management (INM) in action etc.

Training required on activities wise for implantation of Environment Management Plan (EMP) as per Environment Management Safeguard (EMSf) guidelines under RACP as follows:-

Intervention	Activity	Reference of Environment guideline(EG) as per EMSf
Demonstration packing of practices for higher production of selected crops	Crop Selection	EG Agri 1
	Seed Selection	EG Agri 2
	Soil Health & Nutrient Management	EG Agri 3
	Pest & Disease Management	EG Agri 4
	Water use Management	EG Agri 6
	Storage & Handling of Agri-inputs	EG Agri 5
Water Supply Augmentation	Water harvesting structures	EG water 7.1
Value Chain	Farmer Producer Company (FPCs)	EG producer organisation 2.1
	Establishing Food Processing Units	-
	Construction of	EG common 10-1

Intervention	Activity	Reference of Environment guideline(EG) as per EMSF
	Warehouse/ Food processing Unit	

Time Schedule on yearly basis for conducting training on Implementation of Environment management Plan:-

Type of Training	Jan.	Feb.	March	April	May	June	July	August	September	October	November	December
Sensitization												
State Level Training (Training workshops for trainers)												
District Level training Workshops												
Community Level Training Workshops												

Tentative Budget for training (As per yearly basis) as follows:-

SN	Items	Nos.	No. of Days	Qty.	Rate (Rs.)	Unit	Amount (Rs.)	
One Sensitization (One day Training)								
1	Training Kit - pen, note book, folder, Course material, inputs, other utility based required materials, reference literature, Registration etc.	50	1	50	300	Each	15000	
2	Mobility support	1	1	1	2000	Day	2000	
3	Miscellaneous							
	Total	One sensitization training will be carried out in a year						17,000
Two State, Three District and Three Cluster Level training (Two days training).								
1	Training Kit - pen, note book, folder, Course material, inputs, other utility based required materials, reference literature, Registration etc.	40	2	40	300	each	12000	
2	Lodging and Boarding of participants	40	2	40	1000	each	40000	
3	Mobility support	1	1	1	7000	day	7000	
4	Rent for other training facilities (Class-room, LCD, etc.)	1	1	1	15000	day	15000	
5	Travel for participants	40	1	40	300	Person	12000	
6	Miscellaneous							
	Total	Eight numbers of two days training including one day field visit will be carried out in a year.						86,000*8=6,88,000/-
	Grand Total							7,05,000/-

Information, Education and Communication (IEC) & capacity building Strategy and its tentative budget for implementation of Environment Management Plan (EMP) at cluster

Introduction:-

Information, Education and Communication (IEC) is a process of working with individuals, communities, societies and policy & decision makers to develop communication strategies to promote positive behaviours which are appropriate to their Culture & Social/Community behaviours. IEC combine all suitable strategies, approaches and methods that enable individuals, families, groups, organizations and communities to play active role in achieving, protecting and sustaining the desired behavioural change.

IEC plays a pivotal role in creating awareness, mobilizing people, and making development process participatory through advocacy and by sharing knowledge, skills and techniques with the people. It is also critical for bringing about transparency in implementation of programmes at the field level and for promoting the concept of accountability and social audit. There are various techniques of communication, which include mass communication as well as inter personal communication. There are no any fixed formulae and the techniques mobilize and ensuring participatory development .It varies from place to place, according to their specific problems, cultures and social setup.

Strategy for the IEC, Public awareness & Capacity Development.

Principles of strategy for IEC and Public awareness are based on the downward dissemination theory and Convergence theory for the message dissemination, Behaviour change and capacity development on environment management Plan (EMP) of activities under RACP.

Followings strategies shall be adopted at the Implementations level.

- IEC strategy has been prepared; to generate awareness amongst the stakeholders for achieving the objectives of the Rajasthan Agricultural Competitiveness Project (RACP). It is essential to use all type of communication mediums such as Inter Personnel Communication (IPC), Print media, electronic media, outdoor media and folk media. Extensive publicity and designing and printing of IEC material will be undertaken to disseminate the designated communication issues.
- IEC activities taken up in the action plan are telecast and broadcast of issues through electronic media, publication of public appeals in print and extensive use of social media, In addition to this orientation workshops, trainings, designing and printing of IEC material like posters, banners, flex, booklets, leaflets, flip chart and other material, etc will be undertaken.
- The major focus has been given to the grass root level interpersonal activities. The interpersonal communication will help in clearing the doubts of audience and take instant action. The advantage of this medium is that the messages can be communicated to the target audience who are not adequately educated.
- Greater emphasis has been given to grass root level activities whereas some activities have been taken for environment building and positioning the programme in proper perspective across all stakeholders.

The details are follows:-

- i. New media
 - Bulk SMS
 - U –tube and face book
 - What’s up messages
- ii. Reminder Media

- Wall Paintings
 - Slogans
 - Hoardings
- iii. Inter Personal Communication (IPC)
- Workshop
 - Exhibition
 - Community rally
 - Youth Rally
 - Women Rally
 - Rally by School Students
 - Door to door visits
 - Nukkad Natak
 - Essay and drawing competitions
 - Quiz competitions
 - PRA
 - SHG, Water User Association, MTG, FPCs
- iv. Print media
- Printing of IEC materials (Poster, banners, flex, Signboards on the buses, folders at bus stands, Mandi, street etc.

Template for IEC activities

IEC required on activities wise for implantation of Environment Management Plan (EMP) as per Environment Management Safeguard (EMSF) guidelines under RACP as follows:-

Stakeholders	Content of Information as per activity wise under RACP	Reference of Environment guideline(EG) as per EMSF	Methods to convey the Information (Methodology)	Responsibility
House holds	Crop Selection, Seed Selection, Soil Health & Nutrient Management,	EG Agri 1,2,3,4,5,6	IPC with Poster, Leaflet, Brochure	Line Departments and NGOs
Community	Pest & Disease Management, Water use Management, Storage & Handling of Agri-inputs, Water Harvesting Recharge & Storage Structures Farmer Producer company(FPCs),	EG common 11-2 EG producer organisation 12-1 EG common 10-1	Hoarding and workshops of Town leader and IPC at Community level with town leaders and NGOs as community participation. Lecture Series Exhibitions, Panel Discussion and Group meeting.	
Mass level	Establishing Food Processing Units and Construction of Warehouse/ Food processing Unit		Print Media, Electronics Media, Poster, Hoardings, Use of Public Transport and Workshop at village level of Govt. officers and public Representation.	

Tentative Cost Estimation for the IEC & Capacity development activities at Cluster and village level on yearly basis.

SN	Detail of activity	Unit	Unit cost	Estimation Cost	Remarks
1	Workshop at clusters and village level	5	10,000	50,000	One day workshop in village having population more than 500
2	Installation of Hording	10	1000	10,000	Hording Size 8 ft*5ft
3	Community Rally	5	2000	10,000	rally in village having population more than 500
4	Youth rally	5	2000	10,000	Rally in village having population more than 500
5	Women rally	5	2000	10,000	Rally in village having population more than 500
6	Rally by school student	5	2000	10,000	Rally in village having population more than 500 with the participation of all school.
7	Essay and drawing competition	10	1500	15,000	Sensitization of school children

SN	Detail of activity	Unit	Unit cost	Estimation Cost	Remarks
8	Nukkad natak	5	1500	7500	One Nukkad natak at public place
9	Poster	100	500	50,000	Poster size 1.6ft×2ft
10	Leaflet	200	100	20,000	Size A4
11	Brochure	100	200	20,000	Half fold
Total for Cluster				2,12,500/-	

The above expenditures of IEC activities for capacity building on implementation of Environment Management Plan (EMP) are included in budget of sub-component activities of agriculture. This activity will be implemented through DPM with the support of Environment Specialist and NGO. The expenditure of training will be incurred through Project Management Unit. The provision of the training related to EMP has not been included in cluster plan.