

# Mapping the Core Processes and Identifying Actors along with Their Roles, Functions and Linkages in Trout Value Chain in Kashmir, India

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**Abstract**—Rainbow trout (*Oncorhynchus mykiss*) and Brown trout (*Salmo trutta fario*) are the two species of trout which were once introduced by British in waters of Kashmir has well adapted to favorable climatic conditions. Cold water fisheries are one of the emerging sectors in Kashmir valley and trout holds an important place Jammu and Kashmir fisheries. Realizing the immense potential of trout culture in Kashmir region, the state fisheries department started privatizing trout culture under the centrally funded scheme of RKVY in which they provide 80 percent subsidy for raceway construction and supply of feed and seed for the first year since 2009-10 and at present there are 362 private trout farms. To cater the growing demand for trout in the valley, it is important to understand the bottlenecks faced in the propagation of trout culture. Value chain analysis provides a generic framework to understand the various activities and processes, mapping and studying linkages is first step that needs to be done in any value chain analysis. In Kashmir, it is found that trout hatcheries play a crucial role in insuring the continuous supply of trout seed in valley. Feed is most limiting factor in trout culture and the farmer has to incur high cost in payment and in the transportation of feed from the feed mill to farm. Lack of aqua clinic in the Kashmir valley needs to be addressed. Brood stock maintenance, breeding and seed production, technical assistance to private farmer, extension services have to be strengthened and there is need to development healthier environment for new entrepreneurs. It was found that trout farmers do not avail credit facility as there is no well define credit scheme for fisheries in the state. The study showed weak institutional linkages. Research and development should focus more on applied science rather than basic science.

**Keywords**—Trout, Kashmir, value chain, linkages, culture.

## I. INTRODUCTION

THE Jammu and Kashmir state has a unique and diverse climatic conditions and is divided into three regions based on their geographical and climatic conditions. These regions are Jammu, Kashmir and Ladakh. Jammu region experiences tropical climate whereas Kashmir region enjoys temperate climatic condition while Ladakh region is a mountainous cold arid region where temperature drops below minus degree Celsius in winter. The Kashmir region is major contributor in trout production in the country [1]. The state has total of 0.3 lakh hectare of inland water bodies in the form of 27781 km of

rivers and canals, 0.7 lakh hectare of reservoir, 0.17 lakh tanks & ponds lakh hectare and 0.06 lakh hectare flood plain lake/derelict waters. The Kashmir region of the state has 447 km of stream, 486 km of rivers and about 157 sq. km of lakes [6]. The state has recognized cold water fisheries as one of the important source for generating employment. Trout, once introduced by British for recreational purpose, has well adapted the climatic conditions and is flourishing in Kashmir valley [4]. Two species of trout namely Rainbow trout (*Oncorhynchus mykiss*) and Brown trout (*Salmo trutta fario*) are present in Kashmir waters. At present Rainbow trout is being cultured in captivity while Brown trout is used to stock the trout streams and springs for sport fisheries. The breeding of trout is carried out with help of artificial stripping which starts from mid-November till February ending.

There are five trout hatcheries in the state all situated in Kashmir region they are Laribal, Bugdam, Achabal, Kokarnag and Harwan. The Kokarnag trout fish farm project is the largest one and it is famously known mother trout fish farm in Jammu and Kashmir. They have two feed mills one located at Kokarnag and another in Manasbal Trout Farm, which was installed in 2012 with assistance from NFDB with total cost of instalment around 5 crore as reported by the state fisheries department officials [7]. In 2009-10, the fisheries department started privatizing trout culture to generate new employment in fisheries sector mainly focusing the unemployed youth of the state. Extension division of department carry periodic visit to private trout farms and provide necessary technical assistance to new trout farmers. Trout production in the state shows increasing trend and in 2014-15, the department generated the revenue 182.17 lac from the sale of trout [8]. Taking into account of the resources, the Kashmir valley has great potential for trout culture and value chain analysis provide general frame work for tap the untapped resources. The trout value chain in Kashmir has great potential and expected to become key revenue grosser in the state from fisheries sector. As trout is high valued fish and considered as delicacy in developed countries like Denmark, Chile, Netherlands, etc., trout from Kashmir could be exported to hoteliers in metro cities of the country where it can fetch high price. This will help the trout producer to earn more profit which will ultimately uplift their living standard. The first step in any value chain analysis is the identification of the core process. Identification of core process enables us to identify the key actors involved in the chain.

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## II. MATERIAL AND METHOD

Realizing the importance of value chain analysis, this study was undertaken to identify the gaps and constraints faced by the actors involved in the trout value chain. The survey was conducted with the help of well-structured open ended interview schedule following simple random and snowball sampling techniques. A total of 125 samples were surveyed which include 60 farmers, 60 consumers, 3 trout hatcheries, 2 trout feed mills and 1 equipment dealer and necessary information was collected during the period of August-October 2014. Wide participation of different actors was ensured by identifying the key actors and knowing the role, function, linkages in the process of value chain analysis.

Value chain concept was first introduced by Michael Porter as decision support tool and was added onto the competitive strategies paradigm developed by Porter as early as 1979 and later he popularized the term in 1985 best seller book "Competitive advantage: Creating and Sustaining Superior Performance" [3]. He explained that if there is a competition in market, it can improve performance of intermediaries and subsequently improve value of product. But, he also mentioned that there is a chance to decline in performance, so continuance of competition in market is also important aspect. Value chain is vital process that links different activities and maintains competitiveness in market [3]. Mapping the value chain and constructing cost and earnings model for each link in the value chain, allows for a comparison across the various sub-sector in the value chain [2]. The concept of the value chain simply links all the steps in production, processing, and distribution, together- and allows us to analyze each step in relation to the preceding steps and the steps that follow [5]. Mapping of value chain with the help of graphical representation is the first step in value chain analysis. It enables us to understand and identify the key actors and their activities which make up the value chain.

## III. RESULTS AND DISCUSSION

Table I represents important stages in the trout life cycle along with the duration, size and price for particular stage respectively. Trout being a cold water species has slow growth rate and takes almost 12 months to reach to the size of 250 g in farms. The trout is marketed when it reaches to 200-500 g.

Table I represents the different actors involved during different life cycle of trout.

TABLE I  
 STAGES IN LIFE CYCLE OF TROUT, DURATION & PRICE/UNIT

Life stage	Size (mm)	Duration (days)	Price/unit (in Rupees)
Eyed ova	5-7	21-30	0.20
Alevin	15-20	15	0.30
Fry	25-30	30	5.00
Fingerling	40-50	90	5-10
Adults	200-500	365	300-450

\* 1\$=Rs 67.26 as on 03-06-2016.

### A. Actors in Trout Value Chain, along with Their Roles, Functions and Linkages

#### 1. Trout Hatcheries

The trout hatcheries play a crucial role in insuring the continuous supply of trout seed in the value. In doing, so they carry out various function and activities and also maintain both horizontal and vertical linkages for the smooth flow of information and services in the trout value chain. The hatcheries have developed and maintained their own brooder. The breeding season for trout starts in the month of November continues till the end of February every year. The breeding is done through artificial stripping techniques. After fertilizing the eggs with milts, the eggs are incubated in troughs and trays. When the alevin stage is completed, the fries are transferred to be reared in tanks and then it is transferred to nursery pond and reared till it is sold. The availability of trout seed is notified by the department of fisheries through assistant director office of the respective district. The farmers also keep a close contact with extension agent of department of fisheries who are responsible for providing technical assistance to the farmers during the culture period. Trout farmers have to procure the seed from the hatcheries where trout seed are packed in oxygenated poly bags and in some cases the government provides vehicle equipped with oxygen for transportation of seed to the private and government farms in which transportation cost has to be bear by the farmer. The hatcheries are also in contact with DCFR and share valuable information regarding trout seed production. The hatcheries also provide trout seeds to other research institutes which are involved in research regarding trout culture.

#### 2. Trout Feed Mills

Trout feed mills are important components in sustainable development of trout culture in Kashmir. The feed mills produce pelleted feed of different size for the different stages of the trout. In the process of production of feed, these feed mills carry out different activities like procurement of ingredient and right composition of feed required by different life stages of the fish. Different sizes of pelleted feed mills produced in the feed mill are starter diet (zero size), P1 (5-25 g), p2 (25-50 g), P4 (50-100 g), P5 (100-150 g), p6 (table size). Since there are no retail units for the sale of feed the trout farmer has to come to the farm to purchase feed. Due to the lack of retail units for feed in the state, farmers has to incur high transportation cost. So, there is need to establish retail units for feed supply in each district. In addition of feed production, the feed mills maintain a close link with the trout farmer and give technical guidance for the efficient use of the feed on the farm to reduce the cost. Since the new feed mill at Manasbal was established with the financial assistance from NFDB, shows their close linkage between the feed mill operators. The trout feed mills have maintained close linkage with input supplier for timely availability of ingredient in feed preparations. It is reported that DCFR (Directorate of Coldwater Fisheries Research) avails feed from these feed mills for their ongoing projects in trout culture in the state.

### 3. Equipment Dealers

The equipment dealer provides necessary equipment for carrying out trout culture with ease. They provide equipments like handle net, grader, covering net, framed for segregation and they also provide chemicals and test kits required in research institute. Equipment dealer was only available at Srinagar in the entire valley. Therefore, the farmer has to travel long distance in order to purchase the equipments. The equipment dealer carries out various activities in the process of equipment dealing. They take tender from various public departments like fisheries department, agriculture department and other department for the procurement of equipments in the valley. They maintain close links with these public departments for the purpose of business. Since equipments are not manufactured in the valley, they have to import the equipments from other parts of the country. They maintain close links with banks for availing credit.

### 4. Veterinary Stores

Since there is no specified medicine and chemical dealer for trout fish in Kashmir, farmer purchases the required chemicals from the veterinary stores on technical advice from the extension agents. Veterinary stores provide the chemicals and medicines which are required during trout culture period. These veterinary stores play an important role in the absence of aqua-clinic. These veterinary stores also provide technical advice to farmers in order to prevent some expected disease on the farm. They maintain close links with the trout farmers, departments like fisheries, animal husbandry. They maintain close links with credit institution for availing credit for the business. The procurement of medicine is the most difficult one which has to be imported into the valley from other states of the country. There is a strong need to open aqua-clinics in the valley to provide necessary chemicals which are specially required in aquaculture.

### 5. Trout Farmers and Government Rearing Units

The farmers and government trout rearing units are responsible for the production of trout in the valley. Increasing number of trout farms in private sector is responsible for growth in the production trend of trout in the recent years. They play an important role as producer of trout and making the availability of the trout in the valley. The farmers purchase trout seeds from hatcheries which are located in their respective districts. In case if there is no hatchery available in a particular district then the farmers have to purchase it from other districts. The farmers have to bear very high cost of transportation in process of availing seed and feed which are important factors affecting trout production. Farmers carry out different activities on the farm like culturing of trout to sellable size, farm management activities, marketing of trout. The feeding is done twice a day; one in the morning and another in the evening. The farmer has to monitor the water quality, temperature and the flow of water which are important factors in trout culture. They have to keep a check on predatory birds which can injure fish and increase the possibility of secondary infection in fish. Since there is no

marketing facility except few government retail units, the consumers have to purchase it directly from farms.

### 6. Government Retail Unit

Department of fisheries has opened separate retail unit at some trout farms which specifically do marketing of trout to the consumer. They carry out activities like selling of trout to the local consumers, keeping record of the sales, procurement of saleable size of trout from the government farms. They are the integral part of the farm management and maintain close links with trout farmers and consumers. Each consumer can purchase only 1 kg at subsidized rate of 300 Rs/kg if they want to purchase then they are charged at commercial rate of 600 Rs/kg. In case the consumer needs higher quantity of trout, they are recommended to nearby private trout farmers where they are charged at different rates ranging from 350 to 500 Rs/kg. It is observed that due to high quality and taste of trout the consumers' willingness to pay was found to be high.

### 7. Faculty of Fishery Sciences (SKUAST-K)

Faculty of fisheries Sciences is first fisheries institute in the state and has the mandate to carry R&D and produce fisheries professionals in fisheries sector in the state. This institute plays a major role in imparting education on cold-water fisheries by conducting courses on cold-water fisheries and aquaculture. They impart training and organize field visits to different trout farms in the valley for both BSc and MSc students to make them familiarized with the trout culture practices in the valley and developing entrepreneur for trout culture in future. They maintain close links with department of fisheries of J&K, different trout hatcheries and government rearing units. In coming years, this institute has high role to play in research and developments activities in trout culture.

### 8. Directorate of Cold Water Fisheries

The directorate of cold-water fisheries is only national institute which is a pioneer in the research in cold-water species like trout, mahseer, glyptothorax, snow trout etc. They are carrying out various researches on trout culture in Himalayan region; like in states of Arunachal Pradesh, Sikkim, Himachal and Jammu and Kashmir. They play important roles in the development in of trout value chain in Kashmir through research and expertise technical assistance in the development of more hatcheries and farms. There is a need to develop strong linkages with state fisheries department for the development of trout culture in high altitude places. With their expertise technical knowledge and strong linkage with state fisheries departments, they can achieve new high in trout culture in Himalayan region.

### 9. Banks

There were a number of banks operating in Kashmir valley playing a great role in the trout value chain by providing credit on time to the needy. The dealers and suppliers of medicines and chemicals were using the facility for getting credit from Banks. However, the most important actors in the trout value chain i.e. farmers were not using this facility for trout culture in spite of the fact that trout culture is capital intensive

enterprise which requires more capital to start with. Easy subsidy from Department of Fisheries and lack of awareness and technical knowledge about trout farming may be reasons which are hindering the youths in Kashmir valley to take up the bank loans to start trout culture.

#### IV. CONCLUSION

The study revealed that trout value chain was in its initial stage of development in Kashmir and considered as one of key sector for generating employment to youth in the state by Government of Jammu and Kashmir. Trout seed production

and supply, feed production and supply, medicine and equipment supply, culture and harvesting and selling are the Core processes in the trout value chain in Kashmir. The government started privatizing trout farming with the assistance from the central government under RKVY scheme since 2009-10. Under this scheme, the state fisheries department provides 80% subsidy and rest 20% was born by the beneficiary. Study showed that there are weak linkages between farmer and credit institution. There is need to development strong linkages between the key actors which will help to improve trout value chain in Kashmir valley.

TABLE II  
VARIOUS ACTORS INVOLVED AT EACH STAGE OF TROUT LIFE CYCLE

Life cycle or growth stage	Players	Activities
Eye ova	Hatcheries, consumer of egg, fisheries department farms	Incubation and hatching of eggs, supply of eggs to different government and private farms, export of eggs to outside state
Fingerling	Rearing government farms, Private farm,	Rearing in raceway,
Yearling and Juveniles	Rearing farms Government and private farms	Growing to table size and preparing for sale
Adults fish	Government hatcheries Government rearing farm, private farm, consumer, hotelier, indirect consumers.	Preparing brood for breeding season, selling the fish to consumers , consumption by consumer, Tourist visit

TABLE III  
ACTORS IN TROUT VALUE CHAIN, ALONG WITH THEIR ROLES, FUNCTIONS AND LINKAGES

Actors	Role	Function	Activities	Linkages
Trout hatcheries (all government run)	Seed supplier	Production and supply of trout seed	Brood stock maintenance, breeding and seed production, technical assistance to private farmer, extension services	Department of forest, Tourism department, Department of Agriculture, Trout Farmer, Government trout rearing units, Banks ,Faculty of Fisheries (SKUAST), DCFR, NFDB, ICAR, etc.
Trout feed mill	Feed supplier	Production and supply of trout feed	Procurement of feed ingredient, Feed manufacturing, Supply feed to different government and private trout farm, Extension services	Local input supplier, Fish meal supplier, Other feed ingredient supplier, NFDB, DCFR,
Equipment dealers	Equipment and chemical supplier	Import and supply of equipment and chemicals	Procurement of equipment, taking tender for equipment supply from different department like fisheries and agriculture department, supply of gear for fishers, aquarium setting and giving technical assistance for the same,	Fisheries Department, Agriculture Department, SKUAST, Trout farmer Kashmir University, other research institute, Banks
Veterinary stores	Chemical and medicine supplier	Purchase and supply of chemicals and medicine	Procurement of chemical and medicine, technical assistance,	Trout farmer, Fisheries department, department of animal husbandry, Pet dealer, Bank
Trout farmers and Government rearing units	Trout supplier	Production and supply of trout	Culturing of trout to sellable size, farm management activities, marketing of trout,	Hatcheries, feed mills, equipment dealer, vet stores, extension worker, department of fisheries, other trout farmer, fish consumer, Bank
Government retail units	Retailer of trout	Marketing of table size trout	Selling of trout, procurement of saleable size of trout from the government farms, recording of daily trout sale,	Government trout rearing farms, consumers
Faculty of fishery science (SKUAST-K)	Research and education	Human resource development and conduct of research	Providing education and training about trout culture and conducting research on different aspects of trout culture	Department of fisheries, different hatcheries, feed mill,
Directorate of cold water fisheries research institute	Research institution	Conduct of research on trout	Conducting research in cold water fisheries and finding solution and breeding of trout.	Department of fisheries J&K., hatcheries , feed mills
Banks	Credit provider	Provide credit at the time of need	Providing loans to different actors in trout value chain.	Equipment dealer, veterinary stores, trout farmer, etc.

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