Research Article

Value Chain Analysis of Carps (Fish) In Rupandehi, Nepal

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Abstract

A survey was conducted to analyze the value chain of carps among 80 respondents in Rupandehi district. The study was conducted among 80 respondents of which 60 were fish farmers, 10 were traders and 10 were consumers. Data were collected by using a semi-structured questionnaire for household survey, focus group discussion, and key informant interview. Descriptive statistics on socio-demographic and economic variables, SWOT (Strength Weakness Opportunity and Threat) analysis, benefit-cost ratio analysis, value chain map, volume map were used to analyze gathered data. The average family size per household in the study site was 7.40. The average age of the respondents was 40 years and most of the respondents were Madhesi. The majority of the respondents (38.3%) had 5-10 years of fish farming experience. The majority of input costs were feed (71%), pond maintenance (16%), labor (7%), fingerlings (2%), fuel (1%), fertilizer (2%) and lime (1%). The average benefit-cost (B/C) ratio was 1.77. The majority of fish produced in Chhapiya (Rupandehi) was marketed to four places- Chhapiya, Bhairahawa, Butwal, and Parasi. A higher volume of the produced fish went to Bhairahawa and Butwal. The producer share percentage was higher in the National marketing channel; Butwal (60%) than Bhairahawa (59.9%) & Parasi (55.71%) and other local marketing channel (57.35%). The price spread percentage was found higher in Parasi (44.28%) than other regional and local marketing channel. The marketing efficiency value of Butwal (7.07) is highest among Parasi (3.20) and Bhairahawa (4.01). Feed cost & flood for producer and ice availability & transportation problem for the traders were ranked as a major problem.

Keywords: Fish farming; Rupandehi; Value chain analysis.

Introduction

Nepal is a land-locked country lying between China and India with more than 66% of the population involved in agriculture, which contributes about 30% of GDP (MoAD, 2019). Nepal has abundant freshwater resources in the form of rivers, streams, lakes, reservoirs, and ponds with the Gandaki, the Koshi, and the Karnali being the three major river systems of Nepal (Karki, 2016). With the introduction of exotic carps in the early 1950s aquaculture has added a new dimension to commercial fish farming in Nepal (Gurung, 2003). The warm climatic condition of the Terai region favors the faster growth and development of indigenous major carps and other fishes (Kunwar & Adhikari, 2016). Pond fish culture in the lowland Terai region accounts for most of the cultured fish produced in the country (Katz, 1987). The plain Terai alone accounts for

95% of all fish ponds, and the total area devoted to the fisheries industry is greater than 10,718 ha (DOFD, 2017).

The Nepal Agriculture Perspective Plan (APP) has categorized fishery and aquaculture as a small but important and promising sub-sector of agriculture contributing about 2.47 % of agricultural gross domestic product (AGDP) and also considered as the fastest growing sub-sector among agriculture (Labh *et al.*, 2017). The total fish production in Nepal is 91,832 MT in the year 2018/2019 out of which contribution from aquaculture and capture fisheries are 70,832 MT and 21000 MT respectively (CFPCC, 2019). In the fiscal year 2018/19 total pond productivity is 4920 Kg/Ha (MoAD, 2019), Per capita fish availability is 3.11 kg and Agriculture GDP contribution and National GDP contribution by fisheries is 4.18 % and 1.13% respectively (CFPCC, 2019). Fish is a good source of omega-3 fatty acids that helps to prevent heart diseases and also decreases the risk of arrhythmias, triglyceride level, and lowers blood pressure (Harris *et al.*, 2008). Till now, 252 fish species have been recorded in Nepal among which, 236 are indigenous and 16 are exotic in various aquatic ecosystems (Shrestha, 2019). In Rupandehi district, annual fish production in 2012/2013 was 3510 metric tons from 739 hectares (Poudel, 2014). He also mentioned that in order to get to the market, the rate of fish increases by 15% to 25% from the manufacturing site. At present seven commercially important carp species are bred and cultured in Nepal (CFPCC, 2019). Silver carp, bighead carp are sold at the rate of NPR 200-350/kg, while common carp, Rohu, Mrigal, Catla, and Grass carp are sold at the rate of NPR 300-450/kg and NPR 900–1100/kg for rainbow trout. In the Pokhara valley, dried fish, or sukuti, is sold for between 1500 and 2000 per kilogram. Prices for dried and smoked fish in Nepal range from NRs. 300 to 5000 per kg, depending on the type of fish (Pradhan *et al.*, 2017).

The relationship between the various production, processing, and distribution phases can be studied with the use of value chain analysis, which also provides information about the Market product flow (Bellu, 2013). This study was carried out in order to identify the important actors, their relationships, and their responsibilities in the development of the carp value chain in the Rupandehi district.

Research Methodology

Study Area

The survey was carried out in Rupandehi district of Nepal. It covers an area of 1350 km ^{2} and has a population of 8, 80,196 (Central Bureau of Statistics, 2011). The study was conducted in four rural municipalities of Rupandehi district namely Siyari, Mayadevi, Gaidahawa and Sudhhodhan. Rupandehi lies on the south-west part of Nepal in Lumbini province and has it's headquarter at Siddharthanagar. On the east it shares a border with Nawalparasi (Bardaghat Susta East) and Kapilvastu in the west, Palpa in North and India in the south. The elevation of the district lies between 100m to 1229m from sea level. Climatic and soil condition in Rupandehi favors the production of fish.

Sample and Sampling Techniques

Fish farming is the major source of income for the people in the district and the population involved in the fish farming was very high. The total population in the fish farming sector comprises various actors in the value chain i.e. farmers, collectors, processors, wholesalers, retailers, and consumers. A complete enumeration of all the chain actors is constrained by the time factor, budget, and energy. Therefore, a definite sample was selected which is representative of the whole population. Altogether 60 farmers were selected randomly from the list of the farmers of the super zone profile book. Also, 10 traders and 10 consumers were selected based on information obtained from FGD (focus group discussion) and KII (key Informant Interview), while the traders were wholesalers and retailers.

Source of Data

Primary Data:
The primary data were collected from the farmers of the site who have knowledge about the value chain and fish marketing system. Field observation, field survey, focus group discussion (FGD) and key informant survey (KIS) was done to collect primary data.

Secondary Data:
Secondary data were collected from journals, articles, newspapers, related websites, different institutions, and organizations like MoAD, CBS, Super zone profile book, AKC.

Techniques of Data Collection

Field observation along with the interview was the only technique of data collection and farmer's fields were also visited that was very useful in gathering additional information.

Field Survey

A semi structured and pre-tested interview technique (questionnaire) was used to collect information about production, marketing and value adding activities from farmers. Similarly, traders were also interviewed to get information on the marketing system, market price and marketing problems.

Focus Group Discussion (FGD)

An FGD was conducted prior to and after the field survey to get an idea for interview schedule preparation and to verify the data collected through the field survey. It was very helpful to find out various knowledge regarding different aspects. The problems related to production;

marketing & price were discussed in groups to obtain actual information of the study area.

Key Informant Interview (KII)

Different key personnel like government officers, progressive farmers, and leaders were interviewed to get information about different aspects of fish farming in the study area.

Data Analysis

After collection of necessary information, data collected were coded and entered into the computer for analysis. Data analysis was done by using statistical packages for social science (SPSS) and Microsoft Excel (MS-Excel). The data was analyzed by using tools like descriptive statistics, mean, and frequency distribution and by using different formulas. The findings were represented and demonstrated by using tables, figures, bar – diagrams, etc.

Socio-Demographic And Economic Variables

Variables like family size, age of respondent, education status, ethnicity, etc. were analyzed by using simple descriptive statistics such as frequencies, mean, percentage, standard deviation.

Cost of Production

For analyzing the cost of production, the variable cost items and fixed cost items were selected. The variable cost included the seed cost, feed cost, labor cost, cost of pond maintenance, cost of medicine, Cost of lime, fertilizer, and manure. Fixed cost was calculated by adding cost for pond construction, land rent, depreciation cost, and total cost of production was calculated by adding total variable cost and total fixed cost.

Gross Margin Analysis

Gross margin is the value of output by producer, which is evaluated at the farm gate price minus the total variable cost.

Gross margin = Gross return - total variable cost

Where, Gross return= Price × total quantity marketed

Total variable cost = Summation of cost incurred in all the variable items

Benefit-Cost Analysis

Benefit-cost analysis is done after calculating the total cost and gross return from the fish production. Cost of production is calculated by summing the variable as well as fixed cost items in the production process. For calculating gross return, income from products is accounted for. So the benefit-cost analysis can be carried out by using the formula:

Benefit Cost ratio= $\frac{Gross\ return}{total\ cost}$

Marketing Margin and Producer's Share

Marketing Margin (MM) is the difference between the price paid by the consumers and the price received by the farmers. This will be calculated by subtracting farm-gate price from retailer price.

MM = Retailer Price – Farm gate Price

Producer's share is the price received by the farmer expressed as a percentage of the retail price which is paid by the consumer. It can be calculated by the following formula;

Producer's share (Ps) = $\left(\frac{Pf}{Pr}\right) \times 100\%$

Pf = price received by the farmer

Pr = retail price

Marketing Efficiency

Marketing efficiency is the degree of market performance. It is the ratio of market output to marketing input.

Estimation of marketing efficiency by Shepherd's formula

ME = $\frac{Consumer's price}{(Marketing\ cost + Marketing\ margin)}$

Price Spread

The term "price spread" refers to the discrepancy between the price consumers pay and the net price producers receive for a comparable amount of farm products (Aparna & Hanumanthaiah, 2012).

Price spread = $\frac{(Consumer\ Price - Net\ price\ of\ Producer)}{Consumer\ price} * 100$

Indexing of Problem

Different reasons for the production and marketing problem of fish were ranked and analyzed by using the five-point scaling technique. Different problems were ranked as very high, high, medium, low, and very low. The index was calculated by using the following formula;

Iprob= $\frac{Si * Fi}{N}$

Where,

Iprob= Index value for problem
Si= Scale value
Fi=Frequency of the interval
N=total no of respondent

SWOT Analysis

Strength, weakness, opportunity and threats analysis is the most important tools for strategic planning especially in the stage of extracting strategies. It helps to identify internal and external conditions that are favorable and unfavorable to achieve specific objectives.

Results and Discussion

Socio-Demographic Characteristics

The socio-economic characteristics of respondent's households include household head distribution, age of the

respondents, and gender of the respondents, economically active population, and education status of the sample population.

Age of the Respondents

The age of the respondents was categorized into three groups by using mean and standard deviation which has been presented in Table 1.

The majority of the respondents (75%) were between the age group 30-50 years, followed by above 50 years (20%) and less than 30 years (5%). The mean age of the respondents was 40 with a minimum age of 18 years and maximum age of 65 years.

Table 1: Age of respondents

SN	Age groups (Years)	Frequency	Percentage
1	Less than 30	3	5
2	30-50	45	75
3	More than 50	12	20
	Total	60	100

3.3. Gender of respondents

Out of 60 respondents, 49 (81.7%) were male and 11(18.3%) were female (Table 2). The number of male respondents was greater as females are not allowed to move out of the house frequently.

Table 2: Gender of respondents

SN	Gender	Frequency	Percent
1	Male	49	81.7
2	Female	11	18.3
	Total	60	100

3.4. Education level of respondents

Education level was categorized into seven groups. Illiterate are those who cannot read and write while literate are the respondents who can read and write without a grade. About 1.7% of the total respondents were illiterate while 8.3% were literate without a grade. Among others, 18.3% of the respondents had less than 10 years of schooling while 41.7% had passed SLC. About 11.7% of the respondents had 12 years of schooling and 13.3% had a bachelor's degree while 5% had a master's degree (Table 3). The average year of schooling of the respondents was about 9 years.

Table 3: Education level of respondents

SN	Education level	frequency	Percent
1	Illiterate	1	1.7
2	Literate	5	8.3
3	Less than SLC	11	18.3
4	SLC	25	41.7
5	Intermediate	7	11.7
6	Bachelor	8	13.3
7	Masters	3	5.0
	Total	60	100.0

Economically Active Population

Economically active population refers to the population belonging to the age group 15-59 years. Table 4 revealed that the average family size of households surveyed was close to 7 and the average number of economically active population per household was 3.58.

Table 4: Economically active population

SN	Family size	Average	Minimum	Maximum
1	Total member	7.40	3.00	18.00
2	Economically active member	3.58	1.00	10.00

Pond Area

The mean pond area of the farmers was about 1 hectare. The minimum pond area was 0.10 ha while the maximum was 4.80 ha (Table 5).

Table 5: Pond area

SN	Description	Pond area (hectare)
1	Minimum	0.10
2	Maximum	4.8
3	Mean	1

Farming Experience

Farming experience is an important variable that determines the adoption of new technology. Table 6 showed that the majority of the respondents (38.3%) had 5-10 years of experience in fish farming followed by more than 10 years of experience and less than 5 years of experience.

Table 6: Fish farming experience

SN	Fish farming experience	Frequency	Percentage (%)
1	Less than 5 years	16	26.7
2	5 -10 years	23	38.3
3	More than 10 years	21	35
	Total	60	100

Training

Only 63.3% of farmers participated in the training related to fish farming. The training was organized by AKC (Agriculture Knowledge Centre), super-zone office, and other governmental and non-governmental bodies.

Table 7: Training

| SN	Training	Frequency	Percentage
1	Yes	38	63.3
2	No	22	36.7

Cost of Production

The average total cost of production of carps per hectare was about NRs. 13, 70,703 of which the total variable cost was about NRs. 12, 55,005 and the total fixed cost was about NRs. 1, 15,699. Variable cost comprised about

91.55% of the total cost while fixed cost attributed to 8.44% of the total cost. Among variable cost feed costs (70.53%) had the highest share in total cost followed by pond maintenance (16.08%). Similarly, labor, fingerlings, fuel, fertilizer, and lime had 7.27%, 2.28%, 1.31%, 1.81%, and 0.72% share in total variable cost respectively (Table 8 & Fig. 1). In case of the fixed cost, land rent (93.55%) had the highest share in total fixed cost while the share of interest and depreciation was 1.25% and 5.19% respectively (Fig. 2).

Table 8: Cost of production

SN	Particulars (NRs/ha)	Cost (NRs/ha)	Frequency (%)
1	**Variable cost items**		
1.i	Hatchling/Fry/Fingerling	28,600.26	2.28
1.ii	Feed	8,85,192.6	70.53
1.iii	Fuel and electricity	16,495.7	1.31
1.iv	Lime	9,039.957	0.72
1.v	Manure and fertilization	22,722.63	1.81
1.vi	Labor	91,197.88	7.27
1.vii	Maintenance	2,01,755.5	16.08
1.viii	Total Variable Cost(TVC)	12,55,005	100
2	**Fixed cost items**		
2.i	Land rent	1,08,241.8	93.55
2.ii	Interest	1,449.371	1.25
2.iii	Depreciation	6,007.61	5.19
2.iv	Total Fixed Cost(TFC)	1,15,699	100
2.v	Total cost (TC)	13,70,704	100
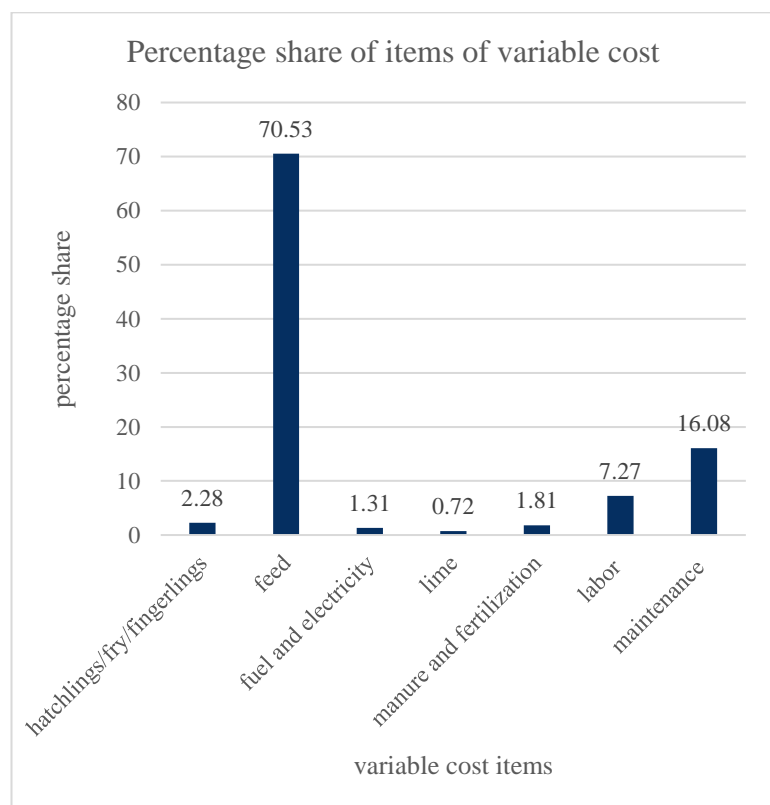
Fig. 1: percentage share of items of variable cost
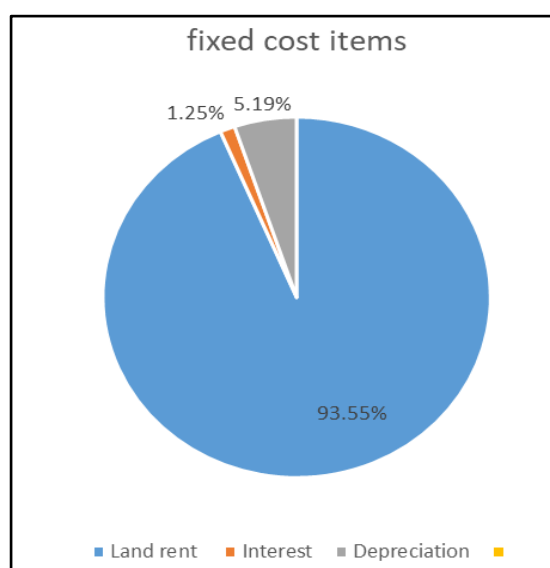
Fig. 2: Percentage share of items on fixed cost

Benefit Cost Ratio

The income of farmers was about NRs. 23, 35,126 /ha and the gross margin was 1280121/ha. The net margin was 1164423 /ha. The value of the B: C (benefit: cost) ratio is 1.77, which implies that carp fish farming was highly beneficial (Table 9).

Table 9: Benefit cost ratio table

SN	Parameters	Value
1	Total cost (NRs/ha)	13,70,704
2	Total Income (NRs/ha)	23,35,126
5	BC ratio	1.77

Marketing

Volume Mapping of Fish:

The producers in Rupandehi mainly sold their fish to wholesalers and retailers. Farmers in Rupandehi sold 80% of the produced fish to wholesalers, 10% of it to the retailer, and the remaining 10% to consumers. All the amount of fish sold to the retailer is sold to consumers later while the fish sold to wholesalers goes to wholesalers of different places. A major amount of fish from the wholesaler is sold to the wholesaler of Bhairahawa (43.48%), followed by Parasi (28.98%) and Butwal (27.54%). Wholesalers in Bhairahawa sold 93.33% of the product to the retailer and the remaining (6.66%) to the consumer directly whereas wholesalers in

Parasi sold 3% of it to consumers and 97% to the retailer. Wholesalers in Butwal sold 94.74% of fish to the retailer and 5.26% to consumers (Fig. 3). Finally, the entire product is sold to the consumers.

Marketing Channel of Carp Fish:

Different marketing channels were traced during the study of marketing of carp fish. The majority of the fish was sold within the Rupandehi district and as Rupandehi district is in the border area some amount of fish was sold in the Indian market too (Fig. 4).

(a) Local marketing channel:
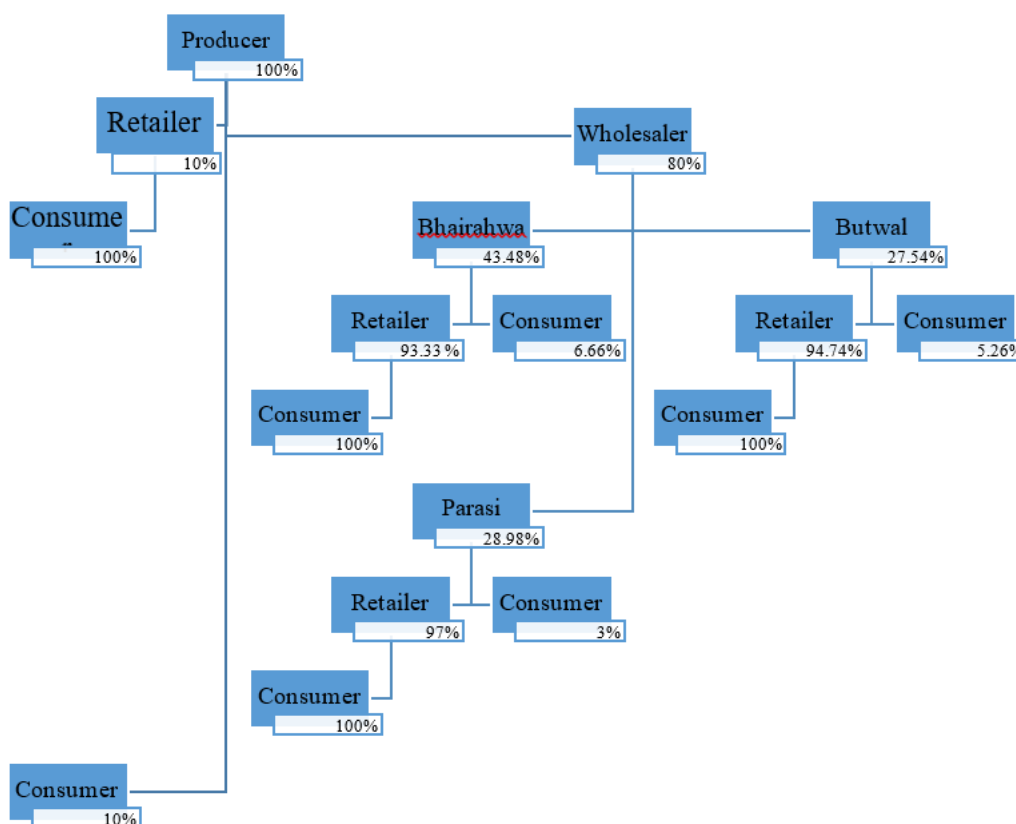
 ➢ *On-farm*

At the local level, the farmer sold fish at NRs 195 to the retailer who sold to the consumer at NRs 340. The price spread for this channel was 42.65%. The producer share was 57.35%.

Price spread = $\frac{(Consumer\ price - The\ net\ price\ of\ producer)}{Consumer\ price}$ * 100%

$= \frac{(340-195)}{340} * 100\% = 42.65\%$

Producer Share $= \frac{the\ selling\ price\ of\ a\ farmer\ (Pf)}{the\ selling\ price\ of\ retailer\ (Pr)} * 100\%$

$= \frac{195}{340} * 100\% = 57.35\%$

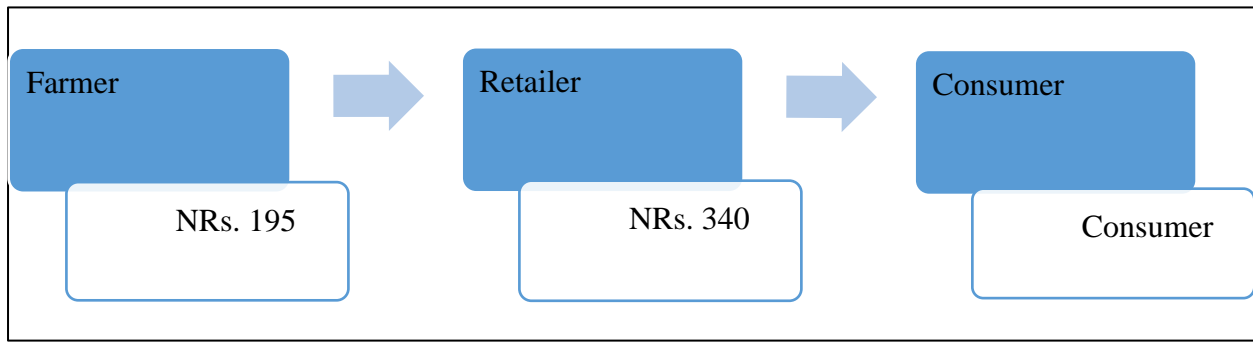**Fig. 3**: Percentage volume mapping of carp fish

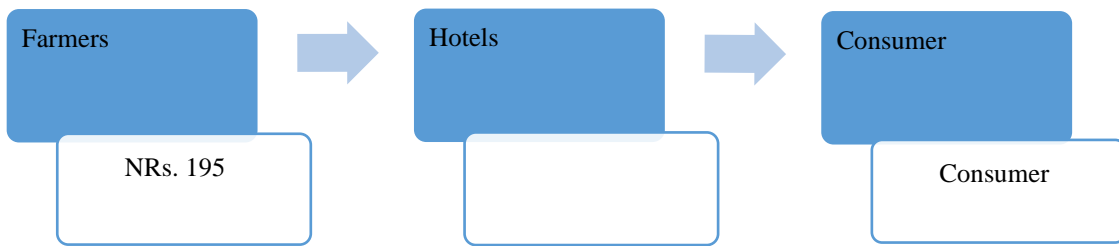**Fig. 4**: Marketing channel on farm to consumer

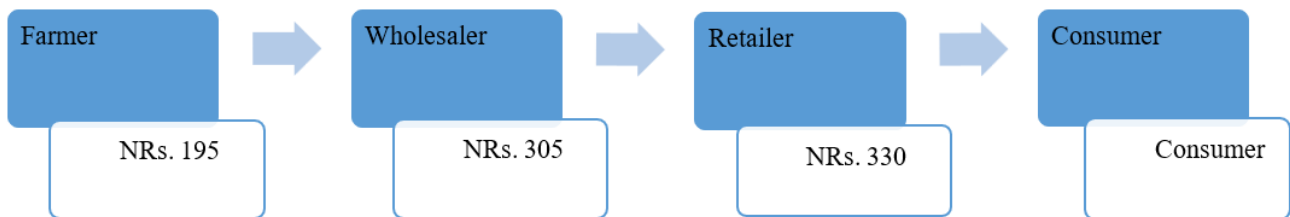**Fig. 5**: Marketing channel on farm to hotels (Rupandehi)

Fig. 6: Marketing channel in Bhairahawa

➤ *On-farm to hotels*

Here, farmers sold their fish to the hotels at the average price of NRs 195. Hotels seem to have to do some value addition activities like making pickles, fish fry, fish gravy, fish chilly, fish momos, etc. Due to these value addition activities, hotels fetch a higher price for the fish and earn more profit margin (Fig. 5).

(b) National marketing channel:

At the national level carp fish that were produced in this area were majorly sold to three places- Bhairahawa, Butwal, and Parasi.

Marketing Channel in Bhairahawa

In the case of Bhairahawa, the wholesaler buys the product from Chhapiya and sells it to the retailer. Retailers then finally sell the product to consumers. Apart from individual consumers the major consumers in Bhairahawa are hotels and party palaces. The producer's share in this chain is 59.09% while the wholesaler's share was 92.42%. The farmers sold fish to the wholesaler at NRs. 195 which was

then sold by wholesalers to the retailer at NRs. 305 and it was finally sold to the consumer at NRs. 330. The value of the price spread was 40.9% for this channel of marketing (Fig. 6).

$$\text{Price spread} = \frac{Consumer\ price - Net\ price\ of\ producer}{Consumer\ price} * 100\%$$
$$= \frac{330-195}{330} * 100\%$$
$$= 40.9\%$$

$$\text{Producer Share} = \frac{selling\ price\ of\ farmer\ (Pf)}{selling\ price\ of\ retailer\ (Pr)} * 100\%$$

$$= \frac{195}{330} * 100\% = 59.9\%$$

In Butwal, the wholesaler bought fish from Chhapiya which they directly sold to the retailers at a price of NRs. 315/Kg. The producer share in this channel was 60% and that of wholesalers was 96.92%. The price spread for this channel was 40%.
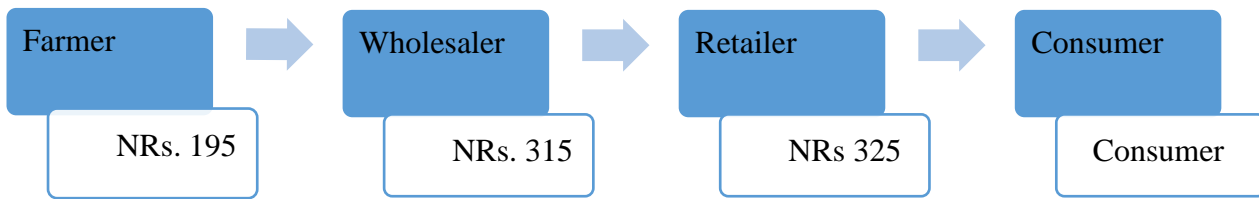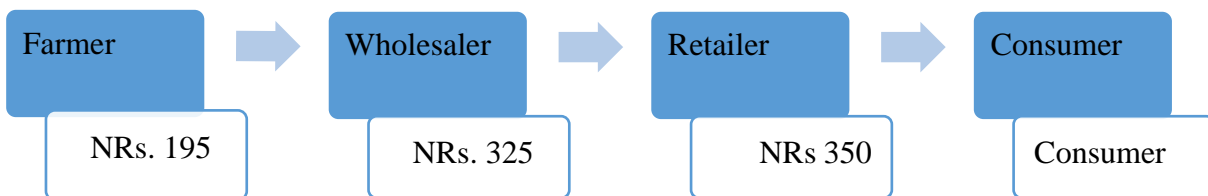
Fig. 7: Marketing channel in Butwal

Fig. 8: Marketing channel in Parasi

Price spread $=\frac{Consumer\ price-Net\ price\ of\ producer}{Consumer\ price} * 100\%$

$=\frac{325-195}{325} * 100\% = 40\%$

Producer Share $=\frac{the\ selling\ price\ of\ a\ farmer\ (Pf)}{the\ selling\ price\ of\ retailer\ (Pr)} * 100\%$

$= \frac{195}{325} * 100\% = 60\%$

In Parasi, wholesalers bought fish from the farmers in Chhapiya at a price of NRs. 195/ Kg then sold it to the retailers at the price of NRs. 325/Kg. After that retailers sold the product to the consumer at the price of NRs. 350/Kg. The producer share in this chain was 55.79% while that of wholesalers share in this chain was 92.85%. Relatively higher consumer prices in Parasi can be attributed to the higher cost of transportation and storage. The value of price spread for this channel was 44.29% (Fig. 8).

Price spread $=\frac{Consumer\ price-Net\ price\ of\ producer}{Consumer\ price} * 100\%$

$=\frac{350-195}{350} * 100\% = 44.28\%$

Producer Share $=\frac{the\ selling\ price\ of\ a\ farmer\ (Pf)}{the\ selling\ price\ of\ retailer\ (pr)} * 100\%$

$= \frac{195}{350} * 100\% = 55.71\%$

Marketing Efficiency

The marketing efficiency is measured with the help of the following formula given by Shepherd. ME = (V/I)-1

Where,

ME = Index of Marketing Efficiency

V= Value of goods sold or consumer price and

I = Total marketing cost or marketing cost per unit.

In the present analysis, the consumer price and marketing cost per kg of carp fish are taken into account.

With an index value of 7.07, the marketing efficiency of Butwal was the highest followed by Bhairahawa (4.01) and Parasi (3.20). The marketing efficiency of the Parasi channel was low due to the higher amount of marketing cost compared to other channels (Table 10).

Table 10: Marketing efficiency of different channel

SN	Place	Total marketing cost per kg	Consumer price	Value
1	Butwal	33.44	270	7.07
2	Parasi	66.53	280	3.20
3	Bhairahawa	57.34	290	4.01

Value Chain Mapping of Carp Fish

➢ **Actors and functions**

Value chain actors are the individuals at each link along the chain to transfer a product from its conception to its final consumption. The value chain actors involved in the fish sub-sector are input suppliers, farmers, wholesalers, retailers, hotels, and restaurants.

➢ *Input supplier*

Input suppliers are those who provide inputs for the production and marketing of fish. The availability of quality input supply at the right time, the right amount, and place play a vital role for farmers to improve production and productivity. Seed, Feed, FYM (Farm Yard Manure), Chemical fertilizer, Medicine, lime are the major inputs required for fish production. Agro vets, hatchery, banks, GOs (Government Organizations), PM-AMP (Prime

Minister Agriculture Modernization Project) are the major sources of input supply. Farmers of the study area got seed mostly from the private hatcheries. They collected Chemical fertilizers, lime, medicines from the agro vets of the local market. Bank provides loans for pond construction and maintenance.

> *Farmers*

Farmers are the ones who are engaged in fish farming to get profit. They are a very important factor in the value chain of fish. They get necessary inputs from input suppliers and that supports fish farming. Most of the farmers in the study area were producing fish in large quantities. They sold their product to the wholesaler, local retailer hotels, and restaurants and formed a link in the value chain map. Amount sold to the local retailer was very minimal as compared to the amount sold to the wholesaler.

> *Wholesalers*

The fish from the farmers were bought by the wholesalers from different places. Wholesalers are those actors who supply the fish to the retailer in large amounts or the hotels and restaurants. They sold the product to the retailer by low-profit margin per unit weight of the product as they were involved in the large transaction. The wholesaler also supplies fish directly to the consumer (Hotel, Party palace) but they get a high-profit margin per unit weight of the product as compared to that sold to the retailers.

> *Retailers*

Retailers are those actors who collect the product from the wholesaler and sell it to the consumer. They are directly connected with the consumer. So for them, it is very important to know about consumer preferences and market demand. They transact low amounts with a high-profit margin per unit weight of the product.

> *Consumers*

Consumers buy fish from retail markets. Consumers can buy fish from the wholesale market at a comparatively cheaper price than from retail markets, but in that case, they need to purchase a whole lot of about 5 to 10 kg. Female consumers, mostly housewives, are frequently found in the retail markets because they have enough time for shopping as the earning person is busy with the job.

> *Hotels and Restaurants*

Hotels and restaurants are those actors who add value to the products and provide a new product to the consumers. They add value to the fish by changing physical appearance such as frying, making momos, chilly, gravy, etc. This value-adding process attracts consumers more and the hotels can earn more profit from this.

> *Enablers*

Enablers are the chain-specific actors that create an enabling environment for the smooth operation of the chain. Enabling the environment favors the value chain. Different government bodies like Prime Minister Agriculture Modernization Project (PMAMP), Agriculture Knowledge Centre (AKC), Nepal Agriculture Research Council (NARC), Central Fisheries Promotion and Conservation Centre (CFPCC).
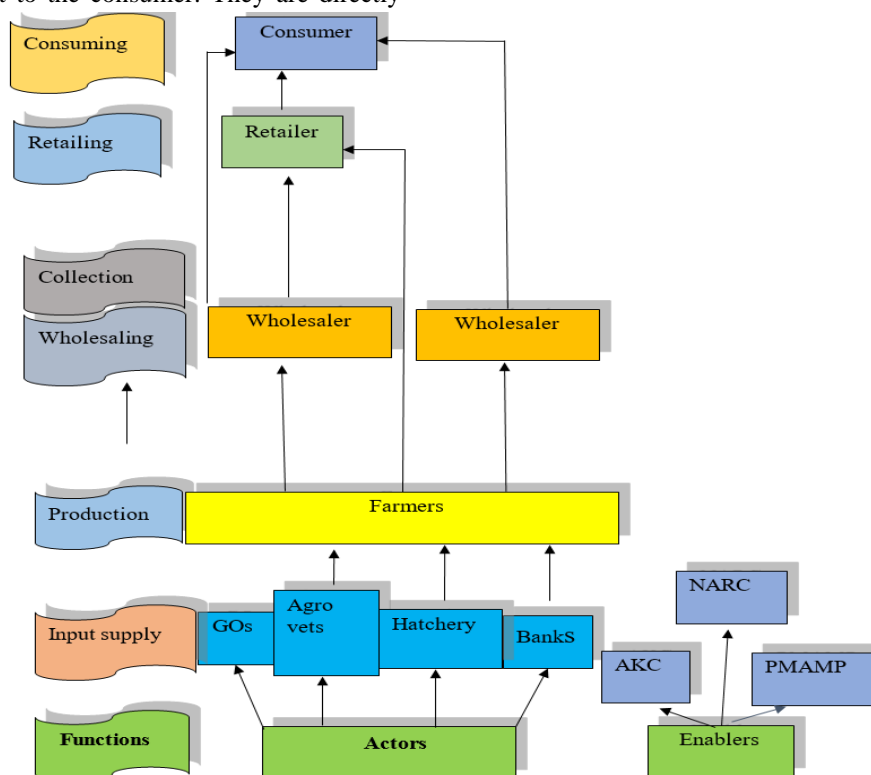

Fig. 9: Value chain mapping of carp fish

SWOT Analysis of Carps (Fish)

Table 11: SWOT analysis of carps

SN	Strength	Weakness
1	Production level ● Climate suitable for carp fish ● Water availability ● Availability of subsidy Availability of labor	Production ● Lack of technical knowledge ● Higher incidence of disease ● Lack of proper post-harvest handling ● High cost of feed
2	Local traders/collectors ● Availability of traders at a different level ● Readily availability of carp fish	Local traders/collectors ● Fluctuation in price ● Lack of horizontal coordination among the local wholesalers
3	Wholesaler ● A large number of fish farmers and wholesalers ● Income generation	Wholesaler ● Involvement of commission agent ● Price fixed by Indian markets
4	Retailers ● Source of income due to higher margin	Retailers ● Competition with other retailers ● Fluctuation in the price of fish

SN	Opportunities	Threats
1	Production level ● Easy input supply ● Easy market ● Subsidies, enablers	Production ● Low-quality input ● Flooding of pond ● Fish diseases ● Competition with the Indian market
2	Local trader/collectors ● Availability of fish ● Transportation facility ● Availability of subsidy	Local trader/collectors ● Scarcity of ice ● Transportation loss
3	Wholesalers ● Efficient linkage with farmers	Wholesalers ● Post-harvest losses
4	Retailers ● High market demand	Retailers ● Transportation injury and loss ● Transportation delay and loss

Problems

Production Problems Faced by Farmers:
Carp fish producers were asked to rank 6 main predesigned problems regarding the production. Based on the rank they gave to each problem, the final weightage of each problem was calculated and finally, an index of each problem was obtained. Based on the index the problems were ranked. The major problem faced by the farmers during the production was the high cost of feed. This was mainly due to the high price of ingredients that were used in preparing feed for the fishes. The second problem faced by the farmers was flooding during the rainy season which could sometimes wipe out an entire fish population. The third problem faced by the farmers was lack of quality inputs such as medicine, lime, and fertilizers Lack of technical knowledge was ranked as the fourth most important problem faced by the farmers followed by lack of capital and diseases. Diseases were ranked last because in this area disease rarely occurs in farmer's ponds (Table 12).

Table 12: Problems faced by farmers

SN	Problems on fish production	Rank
1	High cost of feed	1st
2	Flood during rainy season and scarcity of water during summer	2nd
3	Low quality inputs	3rd
4	Lack of technical knowledge	4th
5	Lack of capital	5th
6	Disease	6th

Table 13: Problem in the marketing of fish in the study area

SN	Problems in the marketing of fish	Frequency					Index	Rank
		1	0.8	0.6	0.4	0.2		
1	Indian market dependent	17	13	4	9	17	0.61	III
2	Monopoly of middleman	10	16	19	10	5	0.65	II
3	Low market price	11	18	16	8	7	0.66	I
4	High cost of marketing	6	11	13	17	13	0.53	V
5	Lack of well managed market	16	2	8	16	18	0.54	IV

Table 14: Problem for traders

SN	Problems for traders	Frequency					Index	Rank
		1	0.8	0.6	0.4	0.2		
1	Scarcity of ice	2	4	2	2	0	0.72	I
2	Transportation loss	2	2	3	2	1	0.64	II
3	Low price	1	1	2	2	4	0.6	III
4	Lack of capital	2	1	2	4	1	0.58	IV
5	Lack of market information	3	2	1	0	4	0.46	V

Problems In the Marketing of Fish in The Study Area:
Various problems were faced in the marketing of carp fish in the study area. 5 major problems were ranked by the index of importance according to the priority of the problem set by respondents. The low market price is the major problem in marketing. As there were fewer middlemen in the study area, monopoly of middlemen was ranked as the second important problem. Indian market dependence and lack of a well-managed market was ranked as a third and fourth most important problem in marketing of fish. The high cost of the marketing was ranked as the fifth important problem in marketing (Table 13).

Problems For the Trader:
Traders of carp fish such as wholesalers and retailers also faced various problems during the trading of the product. The most important problem faced by them was the lack of ice for the proper storage of fish. Loss during transportation of product was a second important problem for the trader. The low price was ranked as the third problem because the traders have to sell their fish at a lower price as compared to other products. Similarly, lack of capital and lack of market information was ranked as fourth and fifth important problems respectively (Table 14).

Summary

The study showed that the percentage of male respondents (81.7%) was higher than female (18. 3%). Majority of the respondents (75%) were between the age group 30-50 years followed by above 50 years (20%) and less than 30 years (5%). The mean age of the respondent was 40.14 years. 11.7% of respondents had 12 years of schooling while 41.7% had passed SLC. 18.3% of respondents had less than 10 years of schooling. Also, 5% had a master's degree and

13.3% had a bachelor's degree.8.3% were literate without a grade, and the remaining 1.7% were illiterate.

The average pond area of the farmer was 1 ha and the majority of the respondents (38.3%) had 5-10 years of farming experience followed by more than 10 years (35%) and less than 5 years (26. 7%). Only 63.3% of farmers participated in the training related to fish farming.

For the production of fish, several inputs were used. Among them, feed cost covered 71% of the total cost, pond maintenance cost covered 16%, labor had 7% share, fingerlings, fuel, fertilizer, and lime had 2%, 1%, 2%, and 1% share in total cost respectively. The benefit-cost ratio of carp fish production was 1.7.

Different marketing channels were identified during the study of marketing of carp fish. Majority of fish and fish products were sold in the local and national market. In Rupandehi, mainly in super zone areas farmers sold fish directly to the wholesaler and retailer of the local market. Especially wholesalers from Bhairahawa, Butwal, and Parasi bought fish from these areas. In Bhairahawa a wholesaler bought fish from the farmers in Chhapiya at a price of NRs 195 and sold it to the retailer at a price of NRs 305. Then retailers sold it to the final consumer at the price of NRs 330. The value of the price spread for this channel was 40.9%. In the case of Butwal, the wholesaler bought fish from the farmer of Chhapiya at NRs 195 per kg and sold it to the retailer at a price of NRs 315 and it was finally sold to the consumer at the price of NRs 325. The value of the price spread for this channel was 40%. In Parasi, wholesalers bought fish from farmers in Chhapiya and sold to retailers at a price of NRs 325 and sold to the consumer at a price of NRs 350. The price spread for this channel was 44.28%.

The major problems faced by farmers in production were the high cost of feed, flood during the rainy season and scarcity of water during summer, lack of quality inputs, lack of technical knowledge, lack of capital, and disease. Other marketing problems faced by farmers were low market price, monopoly of middle man, Indian market-dependent, lack of well-managed market, high cost of marketing.

Conclusion

The study showed that still being age old, fish farming is still a profitable business. However, the farmers are not the ones who have the highest profit, instead they are the middleman. Most of the respondents are male in this survey which depicts that our societies are still male dominated patriarchal societies. High feed cost is the main problem faced by the farmers thus, the state should act upon this problem which could cut off the major problem in fish farming. Absence in vigor of farmers to add value to the products can be clearly seen in the farmer's level. Thus value addition could provide better markets in the national

and international markets and also helps limit middleman intervention. Proper storage facilities or ideal packaging methods would help to transport the products at lesser transportation cost that would increase per capita consumption rate in the country. Thus, both the state and the farmers could step forward to find alternatives in marketing of the product so that farmers could take the highest share of profit than the middle man. However, increasing the production alone cannot help in meeting the demand of people. Proper harvesting and processing of the fish should be done. But few obstacles like absence of cold storage, post-harvest center and processing centers have hindered the increasing profitability of farmers. Inadequate knowledge of consumer's preference among farmers has made them unable to produce fish according to the demand of the people.

Authors' Contributions

Rinu Chaudhary performed the survey. Rinu Chaudhary, Homnath Dhakal, Chandra Kishor Chaudhary and Sandeep Lamichhane prepared the manuscript along with data analysis, edition and the revision of the paper and were also involved in the literature review and the preparation of the questionnaires. All members were involved in the publication process.

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