Original Research Article

Economic analysis of fish production in Dhangadhimai municipality of Siraha district, Nepal

Abstract:

The study, titled " Economic Analysis of Fish Production in Dhangadhimai Municipality of Siraha District, Nepal," was done from March to June 2022. A sum of 60 respondents was examined, 30 from Santanagar and 30 from Fulkahakatti in Dhangadhimai region on an equivalent premise. Utilizing a fundamental irregular examining approach Essential information was assembled utilizing a pre-tried semi-organized survey, while optional information was assembled from different papers and related materials. MS Excel and SPSS-25 were utilized to investigate information utilizing graphic measurements and ordering techniques. The typical total cost of production was found to be Rs 8,98,085.7 with variable costs representing 87.2% and fixed costs representing simply 12.8%. The exploration region's typical fish yield (5340.24 kg/ha) is more prominent than the national average (4300.28 kg/ha) and district average (4800 kg/ha). Numerous production issues were accounted for by respondents, including late inputs supply, a deficiency of quality fingerlings, unreasonable input costs, irresistible diseases and nuisances, and an absence of proper adequate training. Notwithstanding these issues, fish production is an effective industry with a high gross edge (B: C:1.51).

Keywords: Fish, Production, Economic Analysis, Average, Business

1 Introduction:

Aquaculture is one of the most rapidly growing industries worldwide. It is assumed that aquaculture farming contributes 47% to the total fish production in the world (Khanal et al., 2020). By 2030, it is expected that there will be additional 23 million fish food demand in the world due to the increasing population and people's concern regarding nutrition and healthy food which creates a great scope for fish farming in the world (Araujo Rodrigues Nass et al., 2020; Yazew et al., 2020). Aquaculture was created around 3000 BC in China in man-made lakes lodging specific fish species, for example, carp when water levels fell because of stream floods (Araujo Rodrigues Nass et al., 2020). Fish was expensive and scarce in Europe before becoming widespread in monasteries throughout the Middle Ages. Aquaculture declined as a result of transportation advancements in the 19th century that made fish easily accessible and inexpensive even far from the seas (Calixto et al., 2020). After overfishing prompted prices to once again soar, the present boom started in the 1960s. Commercial aquaculture is presently done on a huge scale, which has not previously been mentioned, and it has produced controversy owing to its influence on public waterways beyond the enclosure's bounds (Yazew et al., 2020). Aquaculture is a relatively young activity that began in Nepal in the early 1950s. It originated on a small scale in ponds with seeds from huge native Indian carp imported from India in the mid-1940s. With

the introduction of the exotic carp in the 1950s, significant progress was made (Husen, 2019). Following monoculture techniques, it was successful at reproducing in the 1960s and became very well-liked in the private sector. Three Chinese carp species were introduced and farmed in the 1970s: grass carp, bighead carp, and silver carp. Their ability to reproduce successfully in captivity has significantly advanced aquaculture in Nepal. Similar to this, the country successfully created three commercially significant indigenous large carps by induced breeding: rohu, mrigal, and catla (Rauniyar, 1998). This accomplishment is the result of a polyculture system in ponds that includes seven distinct kinds of fish with diverse eating patterns. This method has greatly increased yield per unit area while also providing economic benefits, and enticing more farmers. The technology truly took off in the early 1980s with the installation of the Aquaculture Development Project, which was supported by the Asian Development Bank (AfDB) and the United Nations Development Program. (UNDP).

Pond aquaculture has evolved to become the most practical and well-liked aquaculture production technology in Nepal and occupies more than 90%of fish production in Nepal (Budhathoki & Sapkota, 2018). Siraha district is one of the 77 districts of Madhesh province which is situated in the terai belt of Nepal. It covers an area of 1,188 sq km having a population of 637,328 according to the census of 2011. The district is made up of 17 municipalities directly under the control of the federal government, eight of which are controlled centrally and nine of which are in rural regions (Chaudhary et al., 2021). Siraha district has significant potential for fish production, revenue, nutrition, and rural development in general, but productivity is poor owing to a lack of management and technical expertise in fish farming which is a challenging issue for increasing market demand and controlling trade in domestic and international fish markets (Majhi, 2021).

This study will help fish zone Siraha to make their further policies and planning. This study will be of great value for the upcoming researcher and scholars undertaking this research survey on the Economic analysis of fish production since it may be cited in the literature. Also, through recommendations for future studies, this study may help the researchers in developing the research titles. So, to understand the baseline information about the existing scenario of fish production, its current progress, future potentialities, possibilities, and the role of improved production technology on the outcome of fish farmers, this research survey can be a fruitful approach.

Table 1: Distribution of fish production in different provinces in Nepal

Province	Water surface Area (ha)	Yield/production (kg/ha)
1	1,819	4693
Madhesh Pradesh	7345	5122
Bagmati	687	4640
Gandaki	313	4030

Lumbini	2865	5043
Karnali	33	2274
Sudurpaschim	414	4300

(MOALD, 2021)

2 Production trend of fish in Siraha district:

According, to the statistical information on Nepalese agriculture 2076/77 (2019/20) Siraha district has 2219 ponds covering 882 hectares of the area by water. Total fish yield (kg/ha) in the Siraha district was found to be 4800 kg/hectare (S. Neupane & Gharti, 2018).

Table 2: Production trend of fish in Siraha district

Fiscal year	**water surface area (ha)**	**Yield/production (kg/hec)**
2015/16	695.66	4839
2016/17	807	4839
2017/18	807	4839
2018/19	837.44	4839
2019/20	882	4800

(MOALD, 2021)

The above table shows that there was only 695.66 ha of land under fish production with a total production of 4839 kg/ha in FY (2015/16). The area under fish cultivation was found constant from the year 2016-18 and the yield was the same. It was found that in the year 2019/20 the yield was 4800 kg/ha.

3 Methods and Methodology:

3.1 Site Selection:

The survey was conducted in Siraha, a Terai area in Madhesh Pradesh. Dhanusha to the west, India to the south, Siraha to the east, and Udayapur to the north are its adjacent districts. Administratively, the district is divided into nine communes and eight rural communes. The district's elevation ranges from 76 to 885 meters above sea level. The monsoon season lasts from June to mid-September, with minimal rain in the winter. The district comprises 122,797 hectares of land, 73,914 of which are arable while the remainder is forests, watersheds, and grasslands (1). It has a population of approximately 7 lakh people and an area of 1188 km^2. The research was conducted in Dhangadhimai, Siraha district, Fish Zone, Siraha PIU. This location was

carefully chosen since it is home to the bulk of fish farmers, who contribute significantly to the district's overall fish production.

Fig 1: Study Area

3.2 Preliminary study

The preliminary study was carried out and different information regarding the feasibility of the research was collected. The features of the research location were assessed by direct observation and in-depth conversations with farmers and dealers. It provided an overview of the fish zone from different aspects which was very much helpful in the preparation of the questionnaire as well as rapport building with farmers and traders.

3.3 Data collection and sampling procedure

The study was conducted from Magh 2078 to Sharwan 2079 and the primary data collection was conducted from Falun to Chaitra 2078. The list of fish rearers of the command area of fish zone Dhangadhimai, Siraha was obtained through zone profile. Out of the total rearers residing in the command area of the fish zone, 30 rearers were selected, each from Santa Nagar and Fulkahakatti, and were surveyed. Thus, the sample comprises 60 respondents selected randomly and proportionately from the two villages. Simple random sampling was done in various stages to obtain the required sample

3.4 Research instruments

3.4.1 Interview schedule

Pretesting of the interview schedule was done to test the validity and effectiveness of the interview schedule with 10 respondents near the study site area. The interview schedule was a bit modified as per the result of pretesting before actually applying to the actual respondent. The interview schedule is in English, while the questions are in Nepali. The questions are developed following the study's unique goals.

3.4.2 Household survey

A household survey was employed to collect data using a pre-tested schedule of closed and open interviews. 60 household including 30 each from Santa Nagar and Fulkahakatti Ward under Dhangadhimai municipality was surveyed.

3.4.3 Key informant interview

Key informant including progressive farmers, AKC, and traders, was interviewed with a series of questions related to the economics of production and marketing of fish at the study site.

3.4.4 Focus group discussion

As a part of the preliminary study for the assessment of economic analysis of fish production in the study site, FGD comprising 5-8 participants was conducted. To debate the matter, progressive farmers from the area, traders, and focal points from the fishing area were employed. A checklist of questions was used for discussing the topic. A checklist of questions was used to guide and facilitate the discussion and a meaningful conclusion will be written in the notebook.

3.5 Sources of data

3.5.1 Primary data

Direct connection with farmers was used to obtain primary data via questionnaire survey, focus group discussion, and KII.

3.5.2 Secondary data

Secondary data was obtained through a review of literature relevant to the research topic. It has included the annual DADO report, research articles, NARC publications, MOALD publications, PMAMP reports, AKC publications, and relevant works.

3.6 Method of Data analysis

The survey's quantitative and qualitative results were analyzed and interpreted using SPSS version 25 and MS Excel. To examine socioeconomic and agricultural variables such as ethnicity, education, land ownership, and so on, simple descriptive statistics such as mean, frequency, and percentage are utilized. To examine data obtained from multiple sources, descriptive approaches are utilized. Simple statistics like mean, frequency, and percentage were calculated and analyzed with SPSS and MS-EXCEL. Mainly tables, charts, diagrams, figures, etc. were used to give a bird's eye view of the research findings.

3.6.1 Cost and Return Analysis

All variable inputs encountered during fish production, including feed, fingerlings/seedlings, medications, labor, chemical fertilizers, organic fertilizer costs, electricity/fuels, lime expenses, and other expenditures, have been considered and assessed at current market rates. projected manufacturing costs.

The total variable cost was estimated by using the following formula:

$$\textbf{Variable Cost (VC)} = C(Fe) + C(Fi) + C(Me) + C(L) + C(F) + C(E) + C(Li) + C(O)$$

Where,

C(Fe)	Cost of feed (NRs/ha)
C(Fi)	Cost of fingerlings (NRs/ha)
C(Me)	Cost of medicine (NRs/ha)
C(L)	Cost of labor (NRs/ha)
C(F)	Cost of fertilizer and manure (NRs/ha)
C(E)	Cost of electricity and fuels (NRs/ha)
C(Li)	Cost of Lime (NRs/ha)
C(O)	Other costs (NRs/ha).

Similarly, the total fixed cost was estimated by using the following formula:

Total Fixed Cost (TFC) = C(PC)+ C(D) + C(EMP) + C(WP) + C(LR) +C(I) +C(B)

Where,

C(PC)	Cost for pond construction (NRs/ha)
C(D)	Cost of depreciation (NRs/ha)
C(EMP)	Cost of the electric motor pump (NRs/ha)
C(WP)	Cost of waterpipe (NRs/ha)
C(LR)	Cost of land rent (NRs/ha)
C(I)	Cost of interest (NRs/ha)
C(B)	Cost of boring/well (NRs/ha)

Pipes, motors, pumps, generators, wells, aerators gas, farm works, and other equipment and gear used in fish farms depreciate at a rate of 10% each year on average. Total production was estimated by multiplying the number of fish produced (kg) by the average harvest price (NRs/kg). Total cost is computed by combining total variable and total fixed costs.

Total cost (TC) = Total Variable Cost (TVC) + Total Fixed Cost (TFC)

The BCR was calculated by using the following formula given by.

Benefit-cost ratio (BCR) = Gross return (GR) / Total Cost (TC)

Similarly, Net profit was calculated by deducting the total cost (TC) of production from total return i.e.,

Net profit (Rs.) = Total return (Rs.) - Total cost (Rs.)

Where,

TC (Rs.) = TVC (Rs.) + TFC (Rs.)

4 Results:

4.1 Socioeconomic and demographic characterization of fish farmers

Population and gender distribution, ethnicity, family size, economically active population, education level, employment, ownership size of land, and fish farming experience were among the respondents' sociodemographic characteristics.

4.2 Sex of the farmer

According to the findings of the survey, the majority of fish farmers are 95% male, with only 5% females in Dhangadhimai, Siraha.

Table 3: Sex profile of the farmer

Sex profile of farmers	Frequency	Percent
male	57	95.0
female	3	5.0
Total	60	100.0

Source: field survey,2022

4.3 Age of the farmers

Farmers' ages were profiled to learn about the engagement of young people in fish farming. However, the data above shows that the majority of fish farming in Dhangadhimai is done by people aged 40-50, farmers of a certain age group. In 50-60 years, the age group accounted for 38.3% of the total number of responders, and similarly, 25% of fish farming was conducted. of the age group, 18.3% are 30-40 years old. of the age group, 10% are 60-70 years old. of the age group, and 8.3% are 20-30% farmers. This table shows that the youths of Siraha have been contributing to fish farming in a decent amount, and hope this number will increase gradually.

Table 4: Age category of the farmers

Age category of farmer	Percent
20-30	8.3
30-40	18.3
40-50	38.3
50-60	25.0
60-70	10.0
Total	100.0

Source: field survey, 2022

4.4 Level of Education

This study shows that most of the farmers (43.3%) had attained only the primary level of education, followed by 21.7% lower secondary level, 15%seconday education, and only 6.7% had attained higher study whereas 13.3% of the farmer had not attained any formal school and are categorized as illiterate.

Table 5: Education level of farmers

level of education	Frequency	Percent
illiterate	8	13.3
primary level	26	43.3
lower secondary	13	21.7
secondary	9	15.0
higher study	4	6.7

Source: field survey, 2022

4.5 The religion of the farmers

Out of 60 respondents of fish farmers in Dhangadhimai municipality, 56 are Hindu and the remaining 4 are Muslim.

Table 6: Religion of the fish farmers

Religion of the farmer	Frequency	Percent
Hindu	56	93.33
Muslim	4	6.67
Total	60	100.0

Source: field survey, 2022

4.6 Ethnicity of farmers

The bulk of fish farmers in Dhangadhimai city, Siraha, are Madhesi, with 53 farmers, followed by four janajati farmers and three Chhetri farmers.

Table 7: Ethnicity of farmers

ethnicity of the farmer	Frequency	Percent
Madhesi	53	88.33
Janajati	4	6.67
Chhetri	3	5
Total	60	100.0

Source: field survey

4.7 Main Occupation

From the above study, it was found that 48 farmers are solely doing fish farming practices as their main occupation whereas 6 farmers are engaged in other agriculture as their main occupation and other 6 farmers have trade business as their main occupation.

Table 8: Main occupation of farmers

main occupation	Frequency	Percent
fish farming	48	80.0
other agriculture	6	10.0
trade	6	10.0
Total	60	100.0

Source: field survey

4.8 Total annual income

According to the report, 40% of farmers have an annual income of 5-7 lakh, 31.7% have 3-5 lakh, 25% have 7-10 lakh, 1.7% have between 1-3 lakh, and other 1.7% earn more than 10 lakh every year.

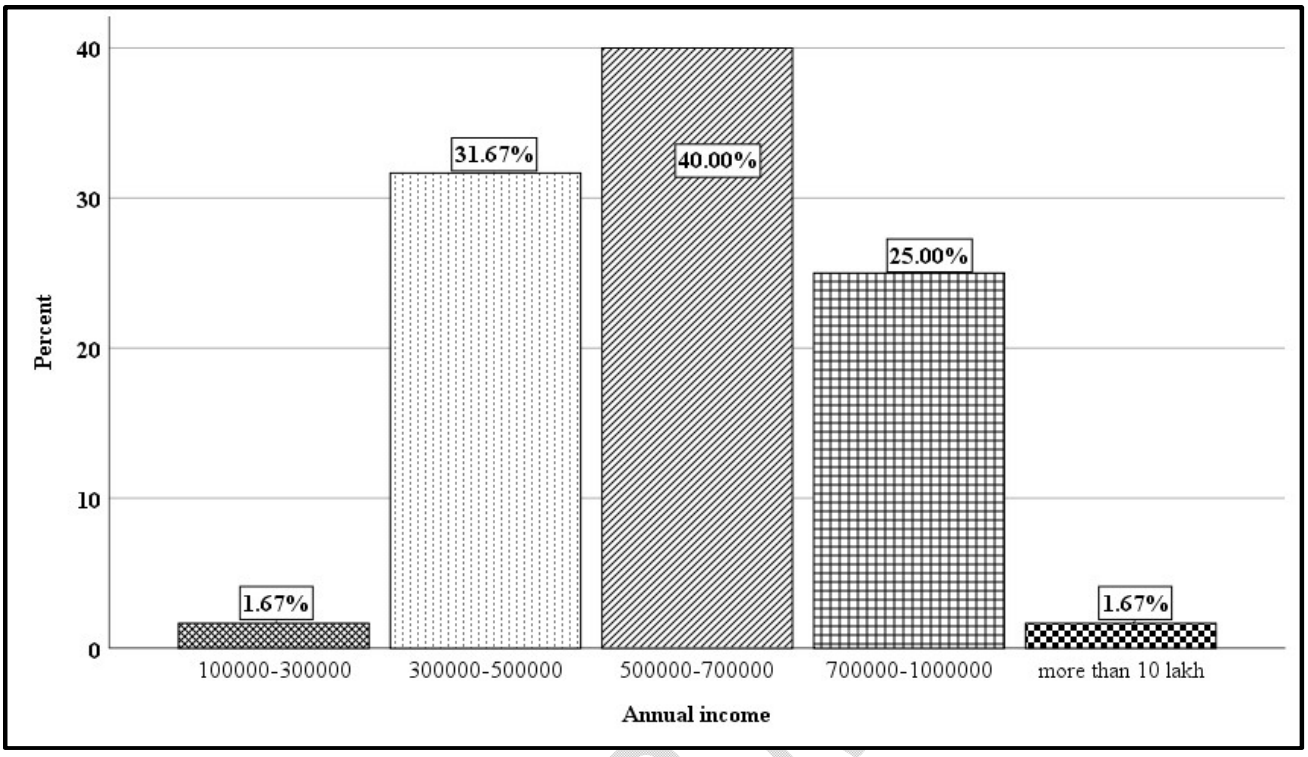

Fig 2: Total annual income

Source: field survey

4.9 Cost and return of fish production

4.9.1 Fixed Cost

Fixed costs are expenses that a company must incur whether it produces one item or a million. He must pay the same amount regardless of productivity. In other words, it is a cost that remains constant even at increased levels of output. Rent, for example, is an example of a fixed expenditure. This fee must be paid regardless of how many things are produced and sold. It is, on the other hand, the polar opposite of variable cost, which changes according to industrial activity. The two basic categories of expenses in a firm are variable costs and fixed costs, which combine to form total costs. The average total fixed cost of the 60 farmers is Rs.115387.81. where pond construction cost was found to be the highest i.e., Rs. 50978.08, followed by land rent cost of 17648.89, the boring cost is Rs. 17210.3, interest loan cost is 12631.96 electric motor pump cost is Rs.11240, and water pipe cost is 5678.40.

Table 9: Average fixed cost per ha per year

particulars	average fixed cost per hectare (Rs.)	total share percent

pond construction cost	50978.08	44.2
electric motor pump cost	11240	9.74
cost of water pipes	5678.40	4.86
land rent cost	17648.89	15.3
interest (loan)cost	12631.96	11
boring /well cost	17210.3	14.9
Total average fixed cost	115387.81	100

Source: Field survey, 2022

4.9.2 Variable Cost

Variable costs are costs that fluctuate when a company's output of goods or services changes. The total marginal cost of all units produced is referred to as variable cost. The average variable cost per hectare in the research region is NRs. 782637.92. The cost of feeding per hectare is NRs. 531253.39, accounting for 67.88% of total variable expenditures. The labor cost is Rs 64795.89 per hectare. The cost of fingerlings per hectare was Rs 64,149.65, accounting for 8.19% of the total variable cost. The cost of fuel and energy per acre is NRs. 31737.5. Lime costs 9624.90 NRs per hectare on average, chemical fertilizer costs 44305.7 NRs per hectare, and organic fertilizer costs NRs. 10282.87 per hectare, medicine costs 16988.05 NRs per hectare, and another cost is NRs. 9499.94 per hectare.

Table 10: Average variable cost per ha. Per year

Particulars	Average Variable cost per hectare per year	Total share percent
feed cost	531253.39	67.88
fingerling cost	64149.65	8.19
fuel and energy cost	31737.5	4.04
labor cost	64795.89	8.27
lime cost	9624.90	1.22
Others cost	9499.94	1.21
chemical fertilizer cost	44305.7	5.6

Organic manure cost	10282.87	1.31
medicine cost	16988.05	2.2
Total average variable cost	782637.92	100

Source: field survey,2022

4.9.3 Average Total cost per hectare of the pond:

The average share of variable costs per hectare in total production costs is about 87.2% and the share of fixed costs is 12.8% and the results are consistent.

Table 11: Average total cost of production

particulars	cost	total share percent
average total variable cost per hectare	782637.9	87.2
average total fixed cost per hectare	115387.81	12.8
average total cost per hectare	898025.7	100

Source: field survey,2022

4.9.4 Total return per hectare:

The average total return per hectare was found to be Rs. 1352,875.09.

Table 12: Total return per hectare

	Minimum	Maximum	Mean	Std. Deviation
Total Return per hectare	1125000.00	1716000.00	1352,875.09	109464.63527

Source: field survey,2022

4.9.5 Net return per hectare:

The average net return per hectare of 60 fish farmers was found to be Rs. 414367.66

Table 13: Net return per hectare

	Minimum	Maximum	Mean	Std. Deviation
Net return per hectare	168675	809400	414367.66	130399.42

Source: field survey, 2022

4.9.6 Productivity of fish per hectare

Table 14: Productivity of fish per hectare of pond

	Minimum	Maximum	Mean	Std. Deviation
productivity	150.00	220.00	178.03	13.58

Source: field survey,2022

4.9.7 Benefit-cost ratio analysis (BCR):

The benefit-cost ratio (BCR) is a monetary or qualitative indication of the connection between the relative costs and benefits of a proposed project. If a project's BCR exceeds 1.0, it must generate a positive net present value to the firm and its investors.

BCR = Total return per ha. / Total cost per ha.

= Rs.1352,875.09 / Rs. 898025.73

=1.51

Here, BCR 1.51 indicates that fish farming in Dhangadhimai is profitable.

4.10 Status of fish production in Dhangadhimai municipality

4.10.1 Fish culture

Mostly prevalent fish culture system in Nepal is pond fish culture which accounts for more than 90% of production in Nepal and also in the Siraha district but based on the number of species grown in the pond, fish culture is of two types: a) monoculture and b) polyculture.

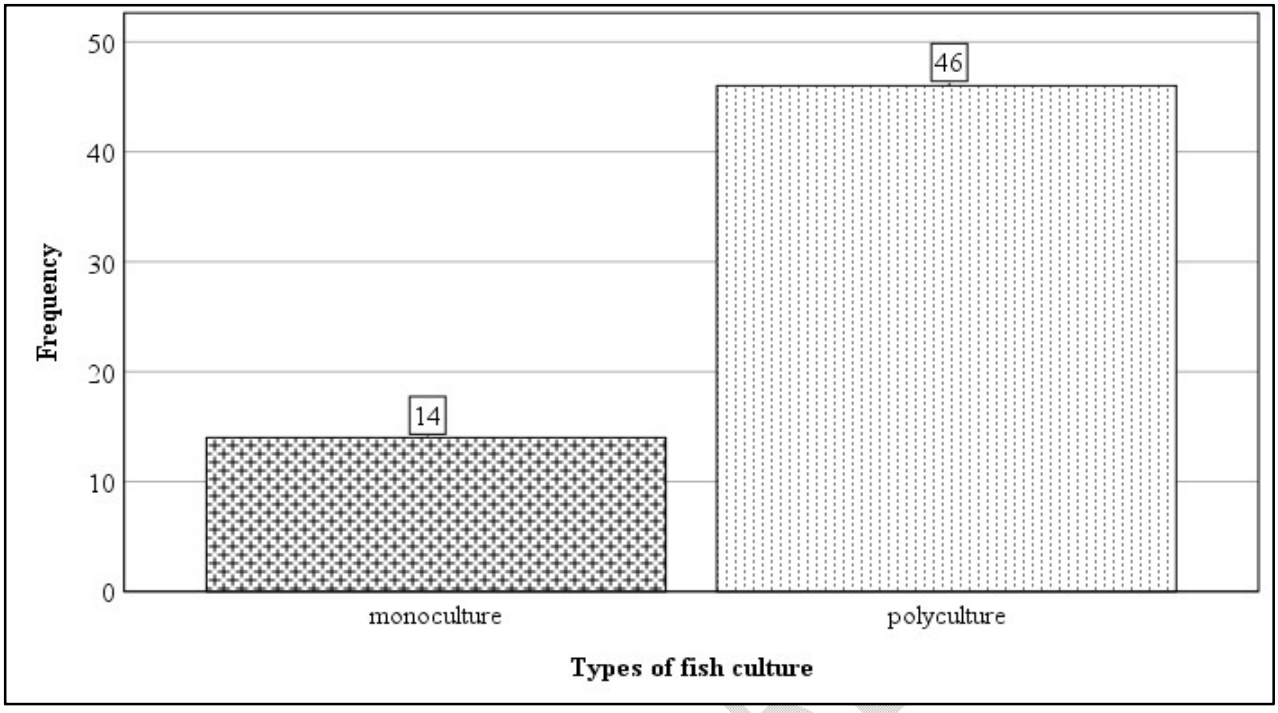

Fig 3: A fish culture based on the number of species grown in a pond

4.10.2 Species grown

Most of the fish farmers in Dhangadhimai are found to be growing major carp species (76.67%) and the remaining 23.33% are growing other species of fish on their farms.

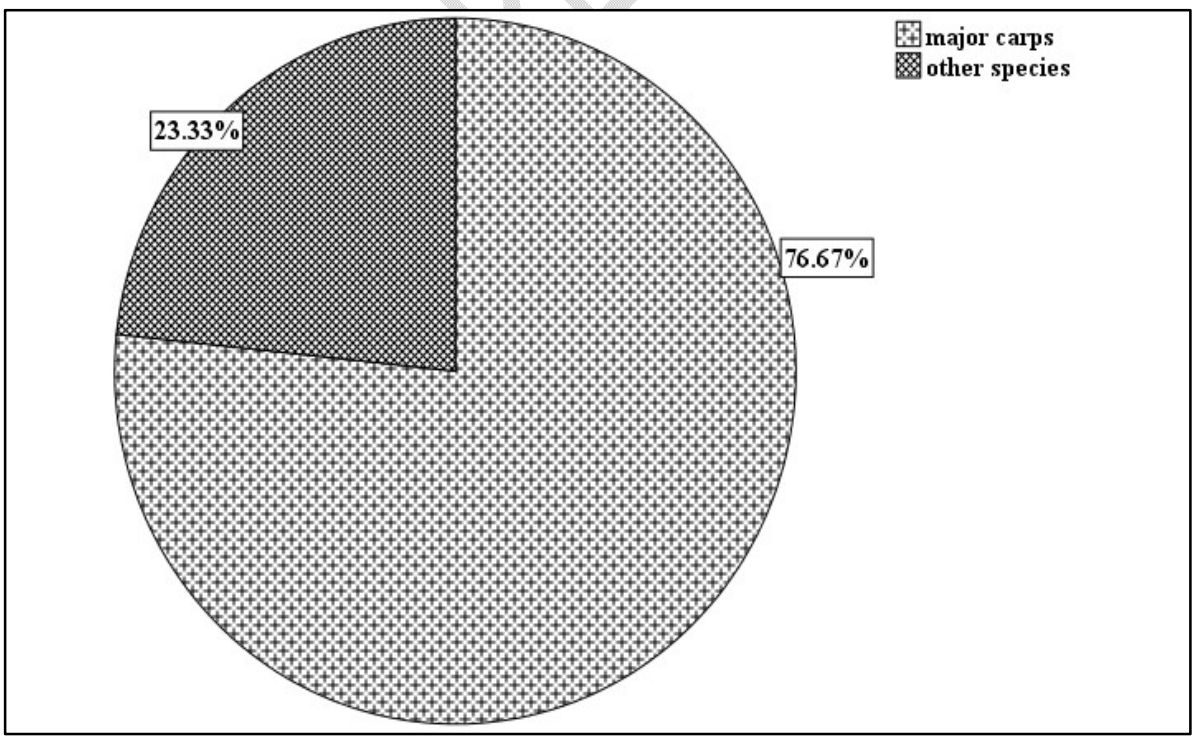

Fig 4: Species grown

4.10.3 Source of fingerlings

It was found that the majority of the farmers use the private farm as their source of fingerlings i.e.,31 farmers out of 60, bring fingerlings from the private farm, 14 from a government farm, 9 from their production, and the remaining 6 from another place like India border.

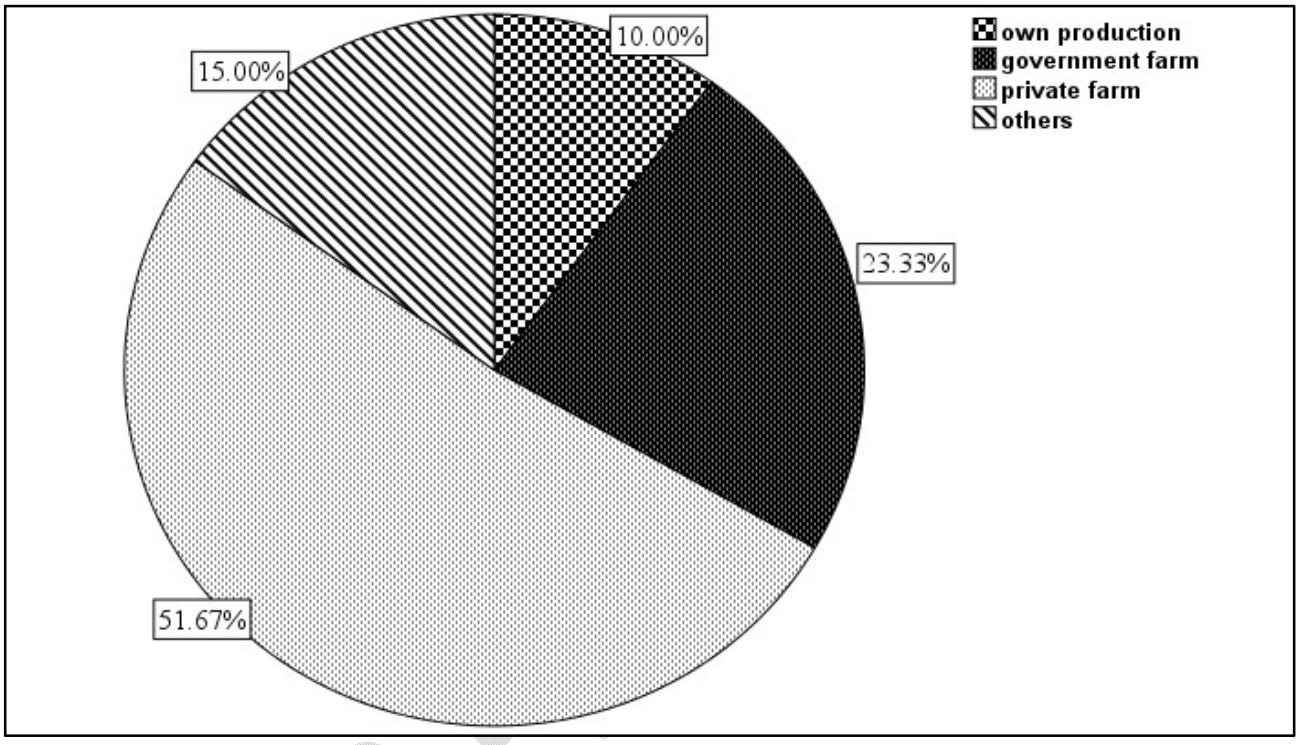

Fig 5: Source of fingerlings

4.10.4 Fish Pond area coverage of the farmers

Out of the total respondent fish farmers, 24 farmers have fish pond area coverage in 1020 Katha. Similarly, 21 households have a fish pond size of 20-30 Katha, 4 farmers have a fish pond area of 30-40 Katha, 5 farmers have a fish pond area of less than 10 Katha, and 6 farmers have a fish pond area that exceeds 40 Katha.

Table 15: Fish Pond area coverage

fish pond area	Frequency	Percent
less than 10 kattha	5	8.3
10-20 kattha	24	40.0

20-30 kattha	21	35.0
30-40 kattha	4	6.7
more than 40 kattha	6	10.0
Total	60	100.0

Source: field survey

4.10.5 Fish farming experience of the farmers

25 of the 60 farmers in Dhangadhimai have been involved in fish farming for 10 to 20 years. Similarly, 20 farmers have been involved in fish farming for 5-10 years and 8 farmers are a bit new and have experience of fewer than 5 years whereas 7 farmers have the most experience among all of the farmers i.e., more than 20 years.

Table 16: Fish farming experience in year

fish farming experience of the respondent	Frequency	Percent
0-5 years	8	13.3
5-10 years	20	33.3
10-20 years	25	41.7
>20 years	7	11.7
Total	60	100.0

Source: field survey,2022

4.10.6 Training and service providers

Dhangadhimai is located in PMAMP's fish farming region, the majority of training programs and services are provided by PMAMP, which contributes 48.33% to the training of city suppliers, followed by primary farmers in this area (20%) and associations. The farmer group has 18.33% while the cooperative has 13.33%.

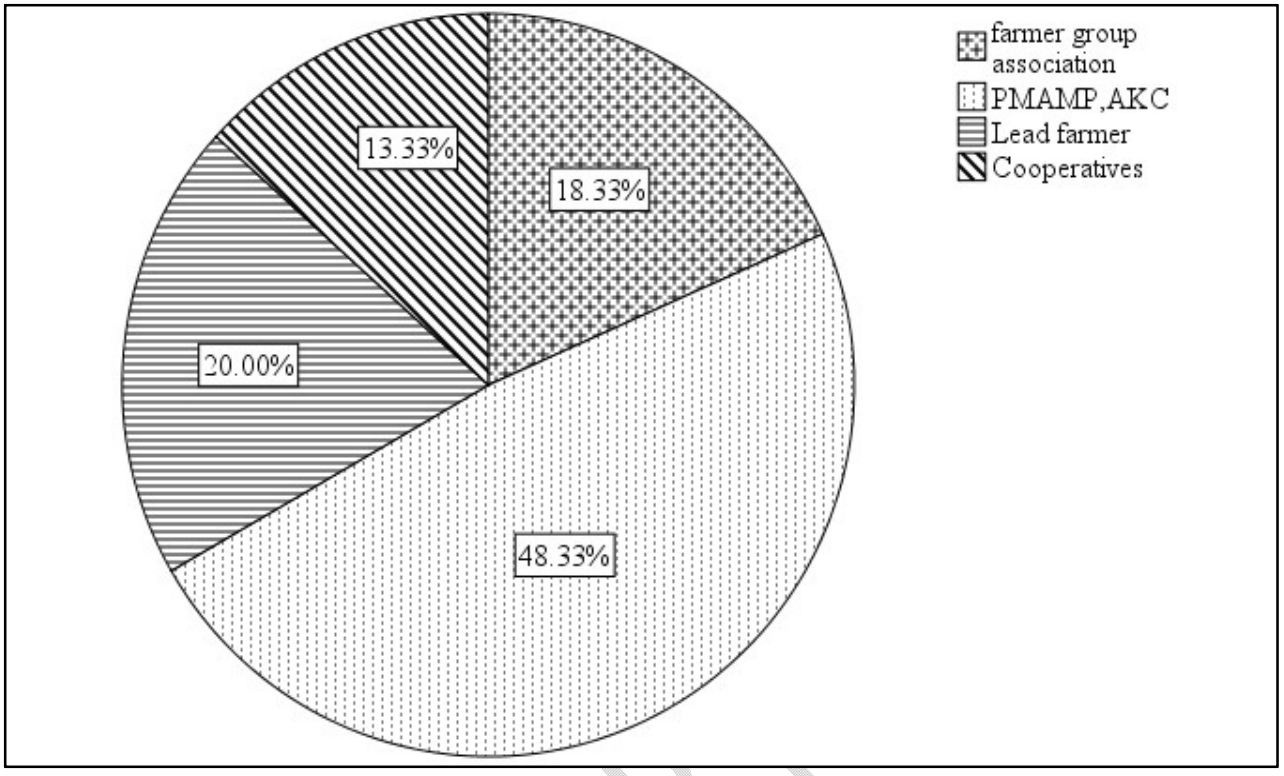

Fig 6: Training and service providers

Source: Field Survey, 2022

4.10.7 Market place for selling the fish

Farmers sell the majority of the fish produced in Dhangadhimai in the local market (65%), then on the farm (18.33%), and 16.67% is sold beyond the districts.

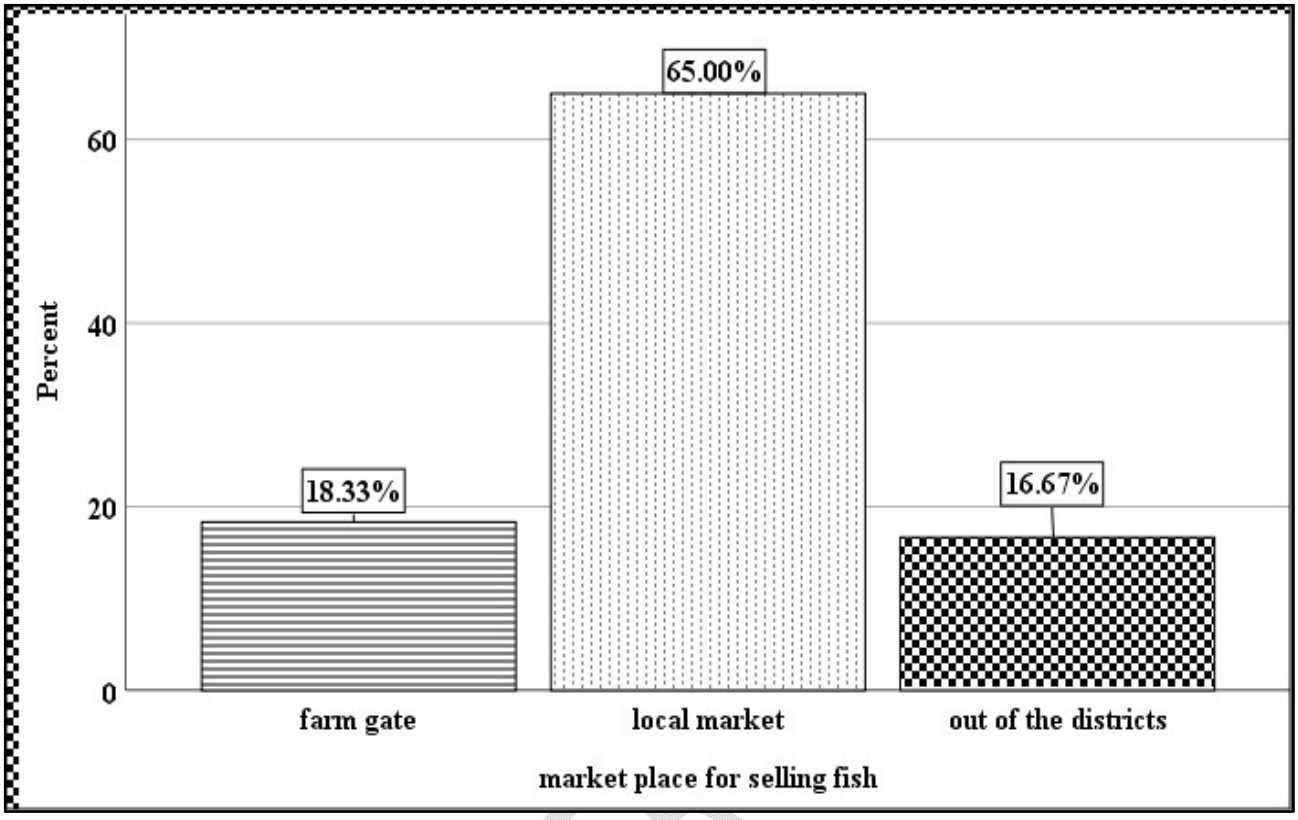

Fig 7: Market place for selling the fish

Source: Field Survey, 2022

4.10.8 Fish price settlers

In Dhangadhimai City, fish prices are mostly settled by discussion between farmers and dealers (53.33%), wholesalers (21.67%), farmers themselves (13.33%), and the government (11.67%).

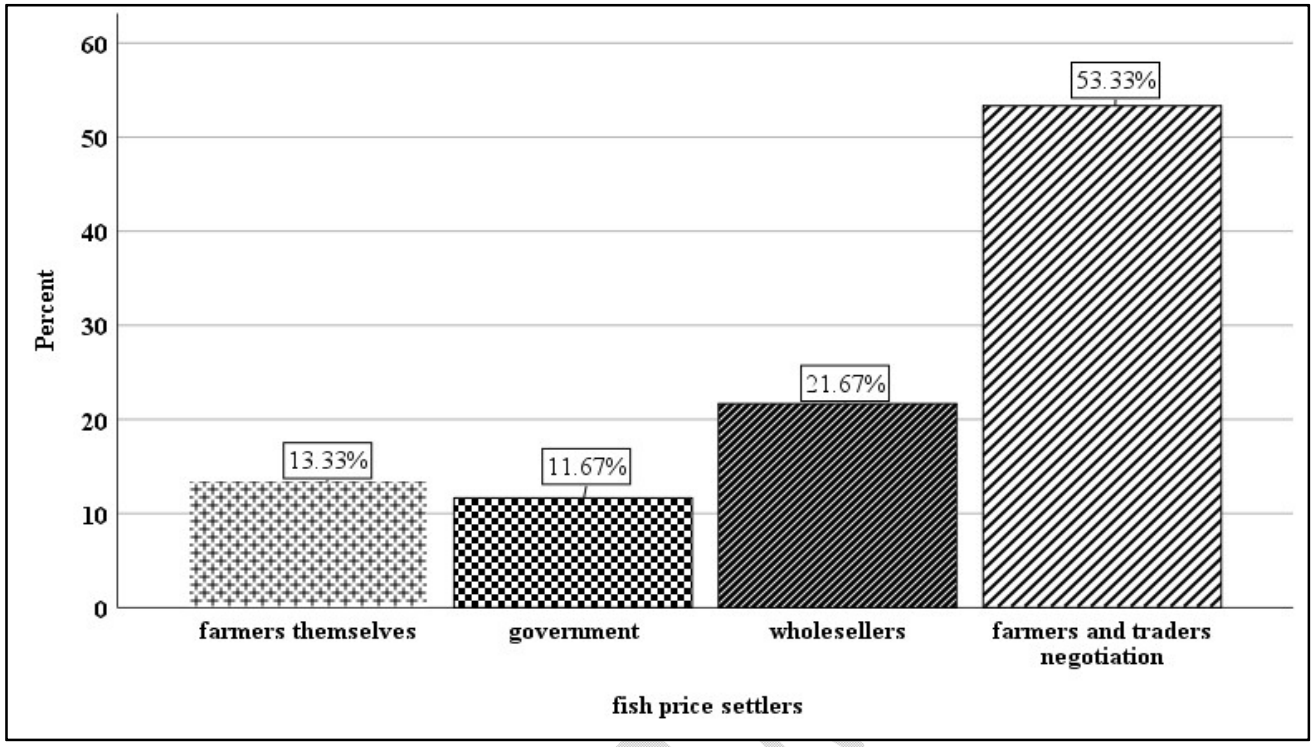

Fig 8: Fish price settlers

Source: Field Survey, 2022

4.10.9 Satisfaction level of the farmer with the price received per kg of fish

While discussing the received fish price per kg of fish in Dhangadhimai, 43.33% of the fish farmers are found to be satisfied whereas 28.34% of the farmers are dissatisfied, and the remaining 28.33% are neutral.

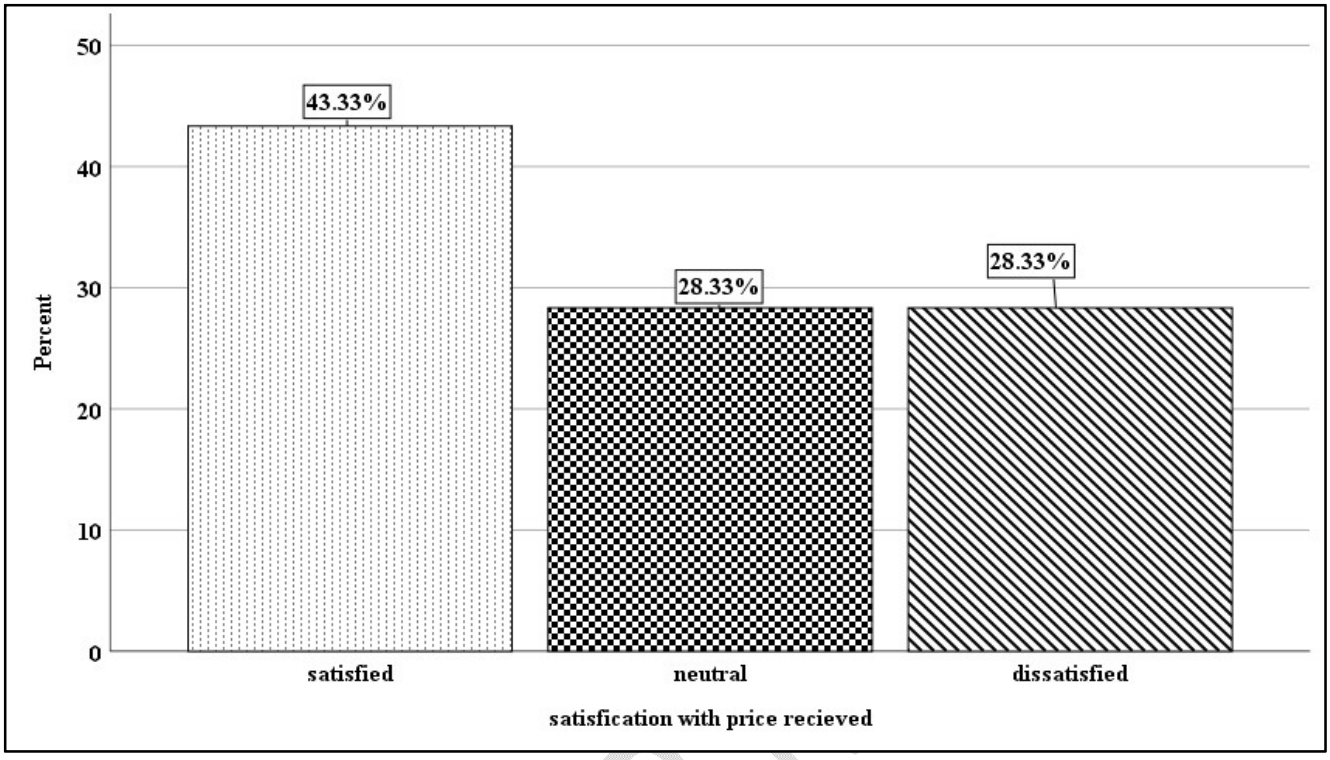

Fig 9: Satisfaction level of the farmer with the price received per kg of fish

Source: Field Survey, 2022

4.10.10 Types of loss or disaster

The disease is the leading cause of fish productivity and farm loss in Dhangadhimai (56.67%), followed by predators (16.67%), flooding (15%), and pollution (11.67%).

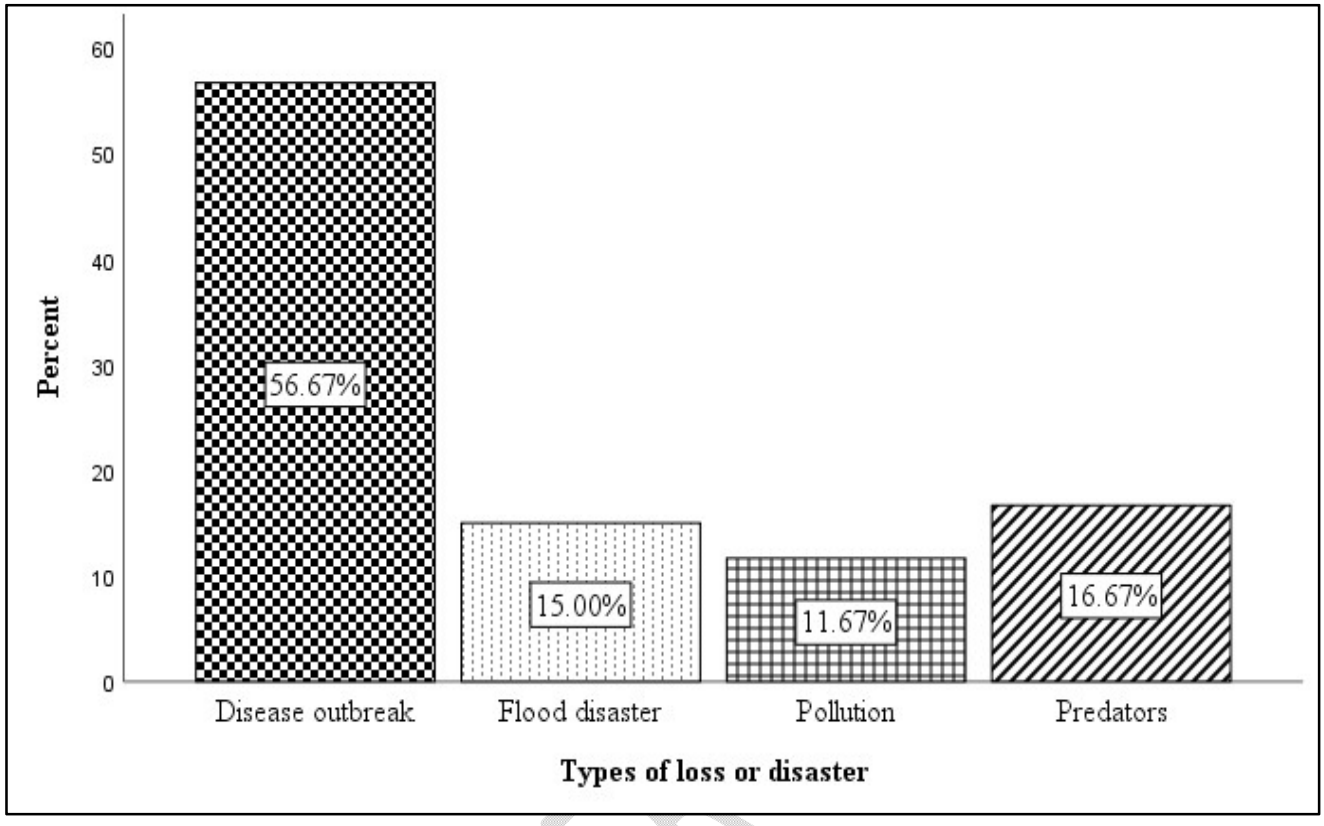

Fig 10: Types of loss or disaster in fish farm

Source: Field Survey, 2022

4.10.11 Insurance of fish farm

Out of the total respondent fish farm in Dhangadhimai municipality, 76.67% of the fish farm have insurance, and the rest 23.33% do not.

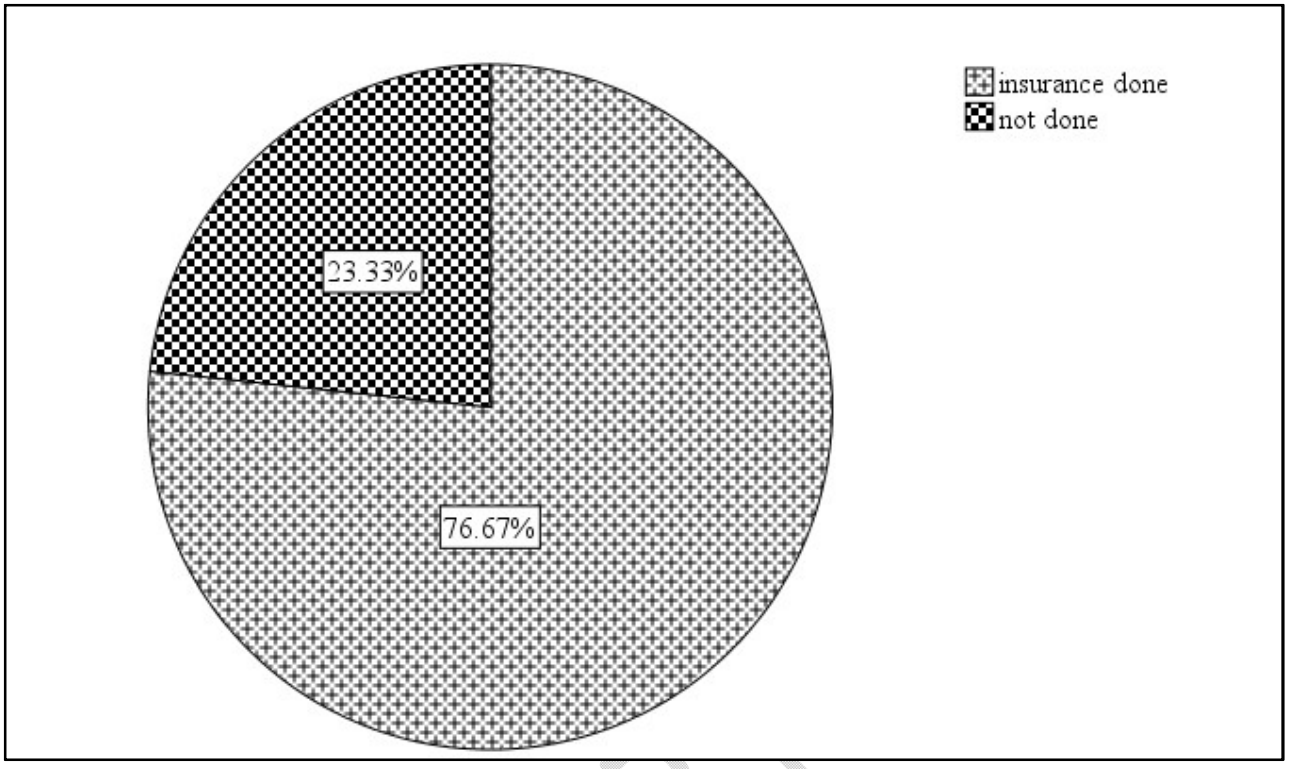

Fig 11: Insurance of fish farm

Source: Field Survey, 2022

4.10.12 Source of loan or financial support

Among 60 fish farmers, 48.33% have not borrowed any loan or financial support from anyone but 33.33% of fish farmers have borrowed a loan from Bank, 10% from friends and relatives followed by 8.33% from cooperatives.

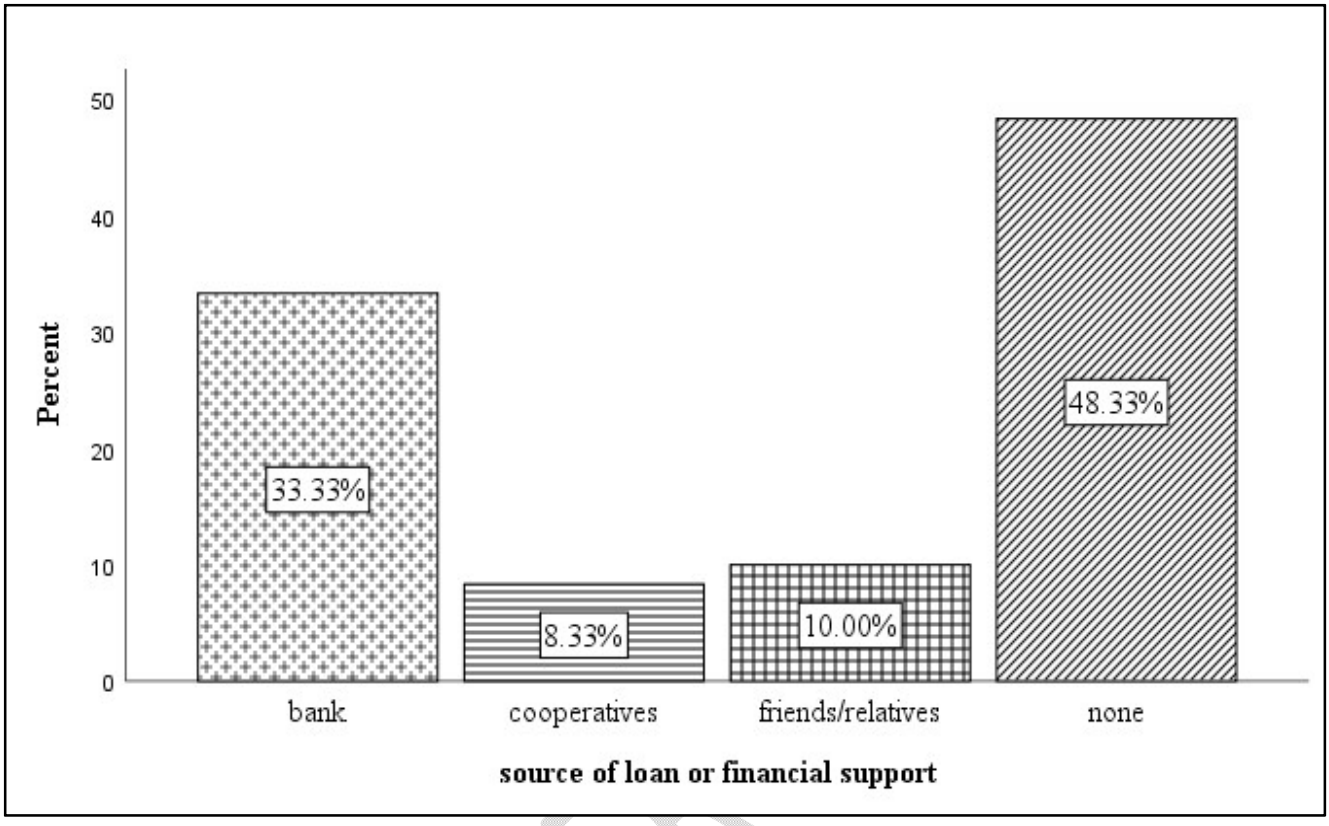

Fig 12: **Source of loan or financial support**

Source: Field Survey, 2022

4.10.13 Indexing (Ranking) of problem

Focus group talks, key informant interviews, and field visits were used to identify five significant difficulties in fish production. Farmers were asked to rank these issues in order of severity. The relative severity of these production issues was measured using a five-point scale (1, 0.8, 0.6, 0.4, and 0.2).

The indexing of the problem is calculated by using the given formula.

$$\textbf{Iprob} = \Sigma \{(Sifi)/N\}$$

Where,

Iprob = Index value for intensity

Σ = Summation

Si = Scale value of ith intensity

fi = Frequency of ith response

N = Total number of respondents

The cost of production in fish farming is the main reason in Nepal that its production area and production have not increased as it had expected. Due to the high cost of inputs, small-scale farmers cannot afford a commercial way of fish farming and they are found doing fish farming conventionally for their consumption only. So, as expected high cost of inputs for fish production is found as the major problem for fish production in commercial fish farmers also with an index value of 0.84. Farmers identified a shortage of quality fingerlings as the second most serious concern, with an index value of 074. Similarly, with an index value of 0,60, the third main issue was recognized as the presence of illnesses and pests. The most common ailment found in the research region was a bacterial infection, which included fin rot and ascites, white spot disease, and EUS (epidermal ulcer syndrome). According to farmers in the research region, the disease's presence causes major output decreases at times. With an index score of 0.53, the fourth significant issue observed was the lack of fry over time. Even though the region has multiple breeding centers, farmers are finding themselves without fingerlings due to the entry of new fish farmers. They are now properly trained as a result of government policy toward fish growers. As this region has been included in the fishing area, PMAMP has made significant efforts in training, technical assistance, information, and subsidies for fish producers.

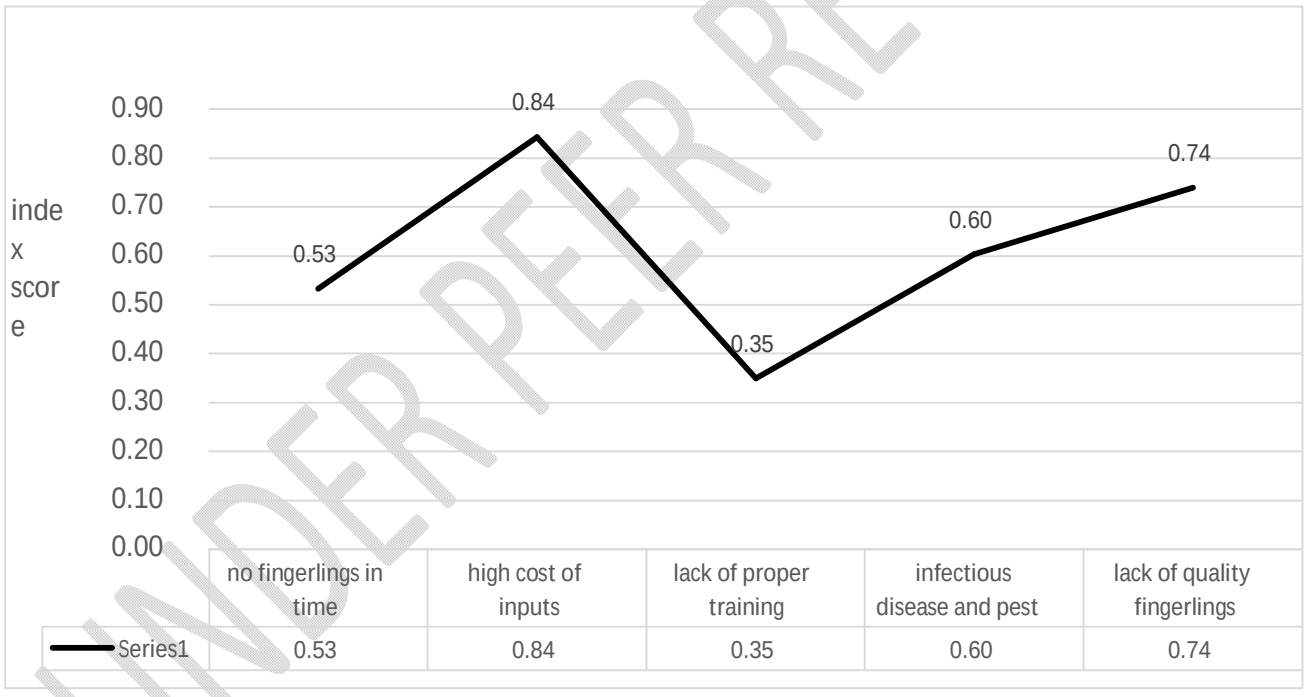

Fig 13: Ranking of problems in the fish production system

5 Discussion:

The average total cost of production in Dhangadhimai City, Siraha, was Rs 898025.7, whereas Sharma and Dhakal's (2018) estimate in the Chitwan district was Rs 743798. This suggests that the research area's production costs are somewhat higher than those calculated by Sharma and

Dhakal in Chitwan County. In Dhangadhimai, variable costs account for approximately 87.2% of total production costs. Feed expenses are the most expensive variable cost factor, accounting for 59% of overall production costs. Variable costs account for 79% of overall production costs, according to Sharma and Dhakal (2018), while variable costs account for 67.55% in the Dhanusha district, according to Koirala and Jha (2021). Similarly, Olasunkanmi (2012) discovered that variable costs account for around 87% of overall production costs, whereas feed costs account for 34% of total production costs in Nigeria. Labor expenses are the second greatest variable cost factor, followed by fingerling costs, maintenance costs, manure and fertilizer, fuel and electricity, limestone, and miscellaneous fees. As a result, producers in this research pay more for feed, labor, and fingerlings. Furthermore, according to the B/C ratio of 1.51, fish production in Dhangadhimai City looks to be a lucrative company. Sharma (2018) computed a B/C ratio of 1.63. Similarly, the B/C ratio for Koirala's (2021) fish output is 1.37.

6 Conclusion:

According to a study based on an economic analysis of fish production in Dhangadhimai municipality of Siraha district, Nepal, fish farming is one of the fastest growing enterprises in the area, employing a huge number of people. In recent years, Dhangadhimai has seen an increase in the number of fish ponds, and many young people in the city are drawn to this farming, however, the net yield in this region is slightly lower than in nearby Terai districts such as Dhanusha, Bara, and Saptari. Fish farming may be a very successful industry that contributes to food security and the economy if suitable technical and economic assistance, services, and facilities are provided. The majority of the fish is consumed in the local district market due to high demand, with just a tiny portion sold to neighboring districts and Kathmandu. Despite the high potential of farmers and traders in Dhangadhimai, Siraha faces several production challenges, including a lack of quality fingerlings in terms of timing, poor pond water quality, high investment costs, and so on. Other challenges include high entry rates, epidemics, and a lack of effective training. As a result, many issues influencing the entire sector must be considered. This would boost the economic viability of fish production in the research region as well as the country's overall aquaculture scenario.

References:

Araujo Rodrigues Nass, R., Povh, J. A., Fornari, D. C., Pereira Ribeiro, R., Brumatti, R. C., & Carneiro Brumatti, R. (2020). Economic analysis of fish productions that use aerators in tanks: A case study in the center-west region of Brazil. *Custos e Agronegocio*, *16*(1).

Budhathoki, R. &, & Sapkota, B. (2018). Fish Farming in Nepal : Trend and Consumption Level. *Acta Scientific Agriculture (Issn: 2581-365X)*, *2*(9).

Calixto, E. S., Santos, D. F. B., Lange, D., Galdiano, M. S., & Rahman, I. U. (2020). Aquaculture in Brazil and worldwide: overview and perspectives. *Journal of Environmental Analysis and Progress*, *5*(1). https://doi.org/10.24221/jeap.5.1.2020.2753.098-107

Chaudhary, P., Kumar Yadav, P., & Kumar Jha, D. (2021). STATUS OF FISH HATCHERY AND NURSERY MANAGEMENT IN, DHANUSHA, NEPAL. *Malaysian Animal Husbandry Journal*, *1*(1). https://doi.org/10.26480/mahj.01.2021.14.25

Husen, M. A. (2019). Fish Marketing System in Nepal: Present Status and Future Prospects. *Int. J. Appl. Sci. Biotechnol*, *7*(1), 1–5. https://doi.org/10.3126/ijasbt.v7i1.xxxxx

Khanal, S., Khatri, S., & Khanal, S. (2020). Production, marketing, and future prospects of fish farming in Nepal: National and global scenario. In *Cogent Food and Agriculture* (Vol. 6, Issue 1). https://doi.org/10.1080/23311932.2020.1860384

Koirala, S., Jha, D. K., Lamsal, A., & Adhikari, A. (2021). PRODUCTION AND MARKETING SYSTEM OF FISH IN DHANUSHA, NEPAL. *Food and Agri Economics Review*, *1*(1), 28–35. https://doi.org/10.26480/faer.01.2021.28.35

Majhi, A. (2021). Integrated Fish Farming. In *Modern Perspectives in Economics, Business and Management Vol. 1*. https://doi.org/10.9734/bpi/mpebm/v1/9751d

MoALD, A. R. 2019/20. (2021). *Statistical Information on Nepalese Agriculture Planning & Development Cooperation Coordination Division Statistics and Analysis Section*. *77*.

Olasunkanmi, J. B. (2012). Economic analysis of fish farming in Osun state, South-Western Nigeria.

Rauniyar, G. P. (1998). Adoption of management and technological practices by fishpond operators in Nepal. *Aquaculture Economics and Management*, *2*(3). https://doi.org/10.1080/13657309809380221

Sharma, T., Dhakal, S. C., Kattel, R. R., Gharti, K., & Lamichhane, J. (2018). Economics of fish production at Chitwan district, Nepal. *Journal of Agriculture and Natural Resources*, *1*(1), 21–31. https://doi.org/10.3126/janr.v1i1.22219

Yazew, T., Kumsa, D., & Daba, A. (2020). Health Benefits of Fish Consumption and Its Contribution to Poverty Alleviation and Food Security in Ethiopia: A Review. *International Journal of Nutrition and Food Sciences*, *9*(4). https://doi.org/10.11648/j.ijnfs.20200904.14