

Improved Aquaculture for Sustainable Livelihood in Majhi Community: A case from Bhimtar, Sindupalchowk

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Abstract

In recent decades, the aquaculture practice is increasing and its contribution for foods is remarkable. Aquaculture has not only contributed in the field of food security; it has created huge employment opportunities and potential economic activities in the global context. To take these advantages, Majhi people from Bhimtar-Sindupalchowk are also practicing aquaculture in 5 ponds with total area of 2000 sqft. And this study was conducted to understand the existing scenario of aquaculture being practiced in those community and assess their livelihood outcomes, so that area of improvement in practice can be figured out. The study has used Sustainable Livelihood Approach framework developed by Department for International Development (an analytical tool to improve our understanding of livelihoods of the poor/ vulnerable people) as a foundation to identify the means and ways to enhance the livelihood of fish farmers. The survey was conducted into 13 HHs out of them 5 were fish farmers and they are producing 124kg fishes in a year. It was found 1 sqft of pond, 0.06 kg of fishes were produced in the year 2075. But this production is very low in compared to other farms. The case study of Srijansil Mahila Macha Palan Samuha has reported 0.2 kg fish production per sq ft from similar size backyard aquaculture. Lack of capital investment, lack of institutional support, dependency on donor organization, lack of site and technical knowledge are found as major constraints and are discussed to find mitigating approaches in the final phase of the study.

Keywords

Aquaculture, Majhi Communities, Sustainable Livelihood, Sustainable Livelihood Framework

1. Introduction

Aquaculture can be simply understood as aquatic farming, where the cultivation of aquatic organisms is done in a controlled process for human consumption. In context to Nepal, aquaculture is limited to only fish farming under extensive and semi-intensive way in earthen or cemented ponds. Fish farming is concentrated in the Terai region (southern plains) (90%) and mainly in earthen ponds (95%) [1].

Previously, fish-catching from natural water bodies was the only option to meet the fish demand. Indigenous fishing tribes were actively involved in such fish catching activity for their livelihood- living along the river banks. They belong to Indigenous Fishing Communities and are Tharu, Majhis, Kumal, Kewat, Mushar, Bote, etc. In recent scenario, due to inadequate fishes after overfishing, high labor, and time taking practice and claiming the water resources as preserved sectors, these people are now shifting

from traditional fishing to aquaculture on man-made ponds. This shift is prominent in the Terai region where the Tharu community is actively engaged in aquaculture. The success of aquaculture has influenced the hilly areas beyond those tribes and are trying to practice fish farming suitable to their locality. So, cage aquaculture in lakes, tanks, and raceways for trout fishes, backyard pond, commercial ponds, and integrated aquaculture has been already started. FAO supports, by promoting sustainable aquaculture development in its member countries and aims to assist them in achieving an increased contribution of this sector to rural development [2]. Though aquaculture is fairly a new activity in Nepal, it is one of the potential livelihood activities to improve socio-economic aspects of the community through the improved food supply, employment, and income.

Livelihood is understood as activities or means performed to secure the necessities to live life. It is everyday life activities carried out repeatedly for

fulfilling the at least basic needs. And sustainable livelihoods will benefit the community with its goods and services sharing dignity and self-esteem to the worker. They will create greater economic and social equity – especially for women and the under-privileged without affecting the natural environment. Aquaculture has also been considered as a sustainable livelihood by Nepal’s fourth national report to the convention on biological diversity [3]. So, farming fish responsibly and sustainably can be year-long livelihood engagements with an opportunity of socio-economic benefits under a balanced ecosystem ensuring food security for future generations.

2. Problem Statement

Bhimtar is a small majhi village in ward number 11 of Indrawati rural municipality of Sindupalchowk district on the northern bank of Indrawati River. Majhi communities are considered a marginalized group of people, who lives on the shores of rivers and practice fishing for their daily livelihood activities.

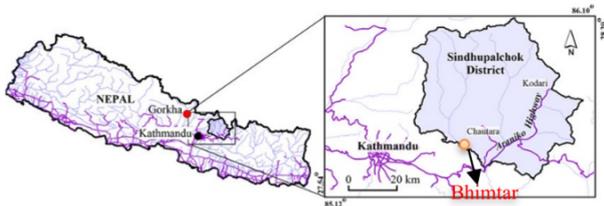


Figure 1: Location of Bhimtar

Limited fishes in the river due to natural water degradation, crusher, and sand industry and increasing involvement of other communities on fishing for commercial and recreational purposes have lowered the fishing share majhi communities resulting in search of alternative sources for income. After the 2015 earthquake, the situation of Majhis degraded more. Natural and economic problems were also raised every next day. They had a very hard time to cope with this shock and their livelihood was badly affected. During the reconstruction period, they were massively involved in reconstruction and daily wages work has been their source of income. After the completion of the reconstruction, without any income activities and limited to household and agriculture work which is not subsistence have been crucial issues of the community. Their life is being complicated day by day. The community responded with searching for new livelihoods like foreign employment, small shops,

animal husbandry, and aquaculture. Some of the Majhis chose aquaculture over foreign employment, inspired from success from terai and trout farming- so that they could revive their traditional livelihood activities with the use of their skills and capacity of traditional fishing.

But to their shock, in this initial stage of aquaculture, the majhis are not being able to produce enough fishes (in comparison to other areas similar to size ponds). Community is in the state, where they are having thought of other income-generating activities. And now few families have their pond without fishes meaning engagement in fish farming is significantly limited. As we know initial investment for pond construction is high and having pond without fingerlings is not a part for sustainable livelihood. Being indigenous people, they have very limited access to resources and are not being successful in their newly started fish farming activities and hence less fish production in their ponds has been a huge problem of the community.

3. Research Objectives

Main Objective:

- To understand the prevailing status of the aquaculture system in the Bhimtar and assess the livelihood outcomes of the community.

Specific objectives:

- To identify the problems in different phases of the aquaculture that has been hindering effective production.
- To develop an improved framework of reliable and effective aquaculture systems for sustainable livelihood in Bhimtar.

4. Rationale

For the fishery sector, the target of the 15th three-year development plan (2076/77 to 2080/81) is to achieve 2700 crore market value production with an annual growth rate of 12.9% every year [4]. To achieve this target, the major policies put forward by the Nepal government are to extend fisheries program in the mid-hills and cooperative based fisheries in the reservoirs, ponds, and wetlands of Terai [5]. On the

other hand, Majhis communities are on the verge of leaving their traditional fishery occupation as they could not sustain in the prevailing scenario. This gap between the national plan and ground reality is distinctly seen, which could neither benefit anyone of them. Therefore, to mitigate the gap with the introduction of aquaculture to the Majhi communities and improving the productivity of existing aquaculture, a sustainable livelihood can be developed.

This study focuses on the socio-economic impacts of aquaculture and challenges for Majhi Community of Bhimtar to dig out tangible and intangible benefits. Those benefits are directly related to Sustainable Development Goals no 1-No Poverty, SDG no 2- Zero Hunger, SDG no 3- Good Health and Wellbeing and SDG no 8- Decent Work and Economic Growth and will play a major role to step on sustainable livelihood practices. Similarly, the district profile report of Sindupalchowk has a slogan of one village one product to promote the village identity [6]. To keep that essence, Bhimtar can explore more in fish farming and can be recognized as a village of fishes in its district. This could revive their native livelihood activities and culture, enhancing the potential of the place to establish a sustainable village.

The results from this study could motivate other Majhis to practice aquaculture and seek benefits of improved food supply, employment, and income generation. Similarly, during the practices of aquaculture, one could aware them-self through training and seminars for capacity buildings and women empowerment in relevant issues resulting in the participatory development of their communities.

5. Methodology

This study is focused on opportunity based social reality to solve the Majhi livelihood problems. And the study is more qualitative supported by quantitative data and hence following the pragmatic paradigm (Constructivism and Post Positivist), this community-based research has been conducted. Social survey method was the basis for data collection where open ended questions and in-depth interview was carried out to understand the contextual livelihood status and existing aquaculture. Close ended questions were used for quantitative analysis of the scenario. From the Department for International Development (DFID) Sustainable Livelihood

Approach, to explore more on the main objective of the research the capital assets and livelihood outcomes of aquaculture are studied. Whereas, specific objectives are covered from the study of vulnerability context and institutions and policies of the chart. All the data related to the pond area, fish production, consumption, sales, investment costs, and incomes were compiled. Descriptive statistics and percentage data were used to compare the results. The findings will reveal the reasons behind the low productivity from the aquaculture and suggest possible recommendations to improve the existing aquaculture. To understand these some livelihood outcomes, the comparative study analysis was done between Agriculture and Aquaculture and other outcomes are analyzed based on the lifestyle and physical context of Bhimtar.

6. Literature Review

6.1 Aquaculture

Aquaculture is the farming of aquatic plants and animals in controlled environments. The scope for expansion of aquaculture is significant: demand for aquatic foodstuffs is rising beyond the capacity of capture fisheries, people are seeking new ways to secure their livelihoods and suitable natural resources for aquaculture exist in many places. When promoted as a component of rural and peri-urban livelihoods, aquaculture can help achieve one or more of the following:

- increase household food supply (a primary target);
- increase household resilience through diversification of income and food sources;
- strengthen marginal economies, increasing employment and reducing food prices;
- improve water resource and nutrient management at household or community level (providing knock-on benefits for other activities such as horticulture and animal production);
- restore aquatic biodiversity through restocking native species; and
- rehabilitate degraded resources (such as weed-choked waterways and abandoned ponds) [7]

6.2 Sustainable Livelihood and Theory

According to Robert (Chambers and Gordon Conway, 1992) livelihood comprises the capabilities, assets (stores, resources, claims, and access) and activities required for a means of living: a livelihood is sustainable which can cope with and recover from stress and shocks, maintain or enhance its capabilities and assets, and provide sustainable livelihood opportunities for the next generation; and which contributes net benefits to other livelihoods at the local and global levels and in the short and long term [8]. The sustainable livelihoods framework helps in thinking holistically about the things that the poor might be very vulnerable to, the assets and resources that help them thrive and survive, and the policies and institutions that impact on their livelihoods [9]. One such framework is the sustainable livelihood approach SFA developed by DFID.

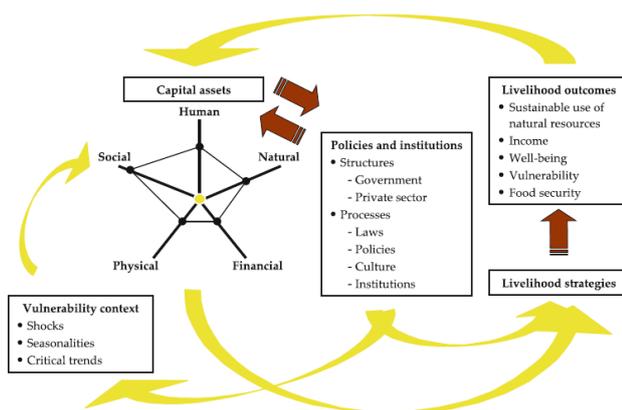


Figure 2: Sustainable Livelihood Approach by DFID

DFID distinguishes five categories of assets (or capital) - natural, social, human, physical, and financial. In aquaculture, natural assets include fish species raised; physical capital includes constructed ponds, human capital includes knowledge of fish culture, financial capital includes income from selling fish, and social capital includes the use of pond water for washing, bathing, etc. by other community households. The figure below shows the sustainable livelihood framework and its various factors, which constraints or enhance livelihood opportunities and show how they relate to each other. The framework provides a way of thinking through the different influences (constraints and opportunities) on livelihoods, and ensuring that important factors are not neglected. The framework shows how, in differing contexts, sustainable livelihoods are achieved through access to a range of livelihood assets which are

combined in the pursuit of different livelihood strategies. Central to the framework is the analysis of the range of formal and informal organizational and institutional factors that influence sustainable livelihood outcomes [9].

7. Case Area

7.1 Introduction to Bhimtar

Approximately a total of 170 people from Majhi ethnic group resides here in 31 households. Most of the houses were built after earthquake and have two rooms and single storey. The major livelihood activity for Bhimtar is agriculture and animal husbandry. It has been the source for day to day living. The household survey says every household has land as bari nearby to their houses and Khet on the bank of the river. The average landholding from the survey comes about 4.26 ropanis of land. From the survey, it was also found that 76.92% of the household has at least one buffalo and more than 30% of HH has pigs and goats. Five HHs were practicing fish farming in their pond and cover more than 38% of the households. Other than agriculture, the livelihood of the Bhimtar was involved in reconstruction work after the earthquake. The survey of 13 people and their major occupations are shown below.

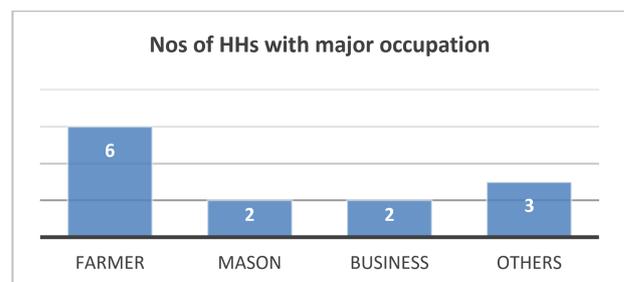


Figure 3: Major Occupation of HH head

7.2 Traditional Fishing and Aquaculture

15 years back, the Majhis used to fish in the Indrawati River using traditional nets. They could catch up to 5 kg fishes at a time. But after the settlement developed along the route of Melamchi to Dolalghat connecting Kathmandu, its impact has reduced the fishes in the pond. The technique of catching fishes through fishing nets are now improvised and limited. The people now spread the nets across the river inside the water to collect the fish swimming along downstream. Once, a very popular technique of dhuwale thune and the use

of herbal poisons are no more in practice due to fewer fish found in the river.

The formal way of doing aquaculture was introduced in the village when an NGO Friends of Shanku (FoS) provided Majhis with training and fingerlings. It was in the year 2062, FoS started forming a tole level social group where locals are motivated for participatory development works. There were four farmers initially involved in aquaculture. Those farmers were provided 200 fingerlings to initiate aquaculture in the community. The project supported them for 3 years with technical and fingerlings supply and the project was terminated. After the project was completed, the activity of the aquaculture was also stopped until 2076 when another NGO Jay Nepal approached them providing 500 fingerlings.

8. Result and Discussion

8.1 Livelihood assets of fish farming in Bhimtar

The sustainable livelihood framework draws attention to five types of capital upon which farmers livelihood depends:

8.1.1 Human Capital

Ability to work and good health: There are 31 houses with an average age of HH head is 43 years ranging from 22 years to 65 years of age. Almost all people over 12 years were involved in income-generating activities like in agriculture, business works, and animal husbandry.

Skills and Experience: The better way to developing skills of fish farming is only possible through training. Four people from that village attained the training for 3 days and developed the basic skills and knowledge to start the aquaculture in 2062 BS. But all the HHs head has the experience of fishing in the river in their past years for income generation.

Education and Knowledge: Most of the mid-age and older population hasn't attained any formal education. Those who have experience of aquaculture, neither of them have completed lower secondary education level. But they were confident that their awareness of health, cleanliness and sanitation and the current political system is no less than any other educated people in the village.

8.1.2 Natural Capital

Water Source: Not only for domestic and agriculture work but also for aquaculture the primary source of water is dependent on the natural source. There is one natural source on the east of the settlement, and hence the aquaculture ponds are also built nearby. There is a huge potential of lifting the water from the Indrawati River if needed for the good of the village as the river is flowing approximately an altitude difference of 25 m.

Land Resources: Upon the survey carried, it was found that every household has an average of 4.26 ropani of khet and bari. But after the flood in Indrawati, the khet is no more cultivable for crops. Such barren land could be good for community-based aquaculture. And also, individual ponds can be excavated in the available bari. There are already 5 ponds built for aquaculture.

Agriculture and Livestock: Agriculture products and livestock by-products can support the life of fishes in different forms. Crops like rice, maize, and wheat in the form of husk and bran can be mixed to form the domestic feed for the fishes which can supplement the market feed to overcome economic burden. Similarly, byproducts and organic manure of livestock help to grow the plankton which is essential food for the fishes.

8.1.3 Social Capital

Social capital in the form of networks, connectedness, cultural norms, and other social attributes have significantly helped in exchanging experiences, sharing of knowledge, and cooperation among rural households. Being a Majhi village, very first they share the same ethnicity, culture, religion, history, and agro-based occupation in the same natural environment. The social bond is further made intact by a local cooperative named Bodegaun Jagaran Krishi Sahakari Sastha from the year 2069 BS. 155 share members have been saving money every month to invest in agriculture work. This institution is one of the major capitals of the Majhis. The rural and marginalized society is very much affected by party-based politics. Considering positive impacts, newly elected representatives from the village have developed networks to higher political leaders, thereby strengthening the social capital of the community.

8.1.4 Physical Capital

After the formation of local government, they are more into physical development in the village with the support of the rural municipality budget or from NGOs. Access of road with scheduled public bus service to Kathmandu and rural municipality office is available for Majhis. 3 crushers are operating on the bank of the Indrawati River. They pay back the Majhis by providing the aggregates and excavators to build the roads. The reconstruction work is on the verge of completion where every family is building 2 room houses. JICA, Jay Nepal, SUK Nepal are working INGOs and NGOs to help them with WASH and livelihood activities. Nearby market to buy or sell things is Sipaghat, which is an hour walk from the village.

8.1.5 Financial Capital

Financial capital denotes the financial resources that people use to achieve their livelihood objectives. Therefore, financial capital refers to incomes, savings, and credit. So, the capital assets for them are dependent on government budgets and subsidy, INGOs financial aid, a loan from the development banks, and local cooperative as they are in the state of no savings. The last year 2075, farmers were provided 10000 Nrs individually from Jay Nepal to build the pond. This financial support is the example of financial capital in Bhimtar. Existing Bodegaun Krishi Jagaran Sahakari Sastha can be considered another financial capital for farmers.

8.2 Comparison of Capital Assets

This comparison is based on the perception survey of the fish farmers from Bhimtar (case area) and Kathar (case study) in the year 2019, where farmers rate their satisfaction level from 1 to 5, and the radar diagram was developed. Apart from comparison, the potential of aquaculture in different sectors can be understood as well. To develop this diagram, the fish farmers were asked about their opinion on the Linkert scale on as mentioned parameters of different capital assets. The average points obtained from the parameters of every asset; those points are located in the graph.

The diagram shows that the outer boundary created by blue lines is the perception of fish farmers from Kathar, Chitwan. The farmers from Kathar have been practicing aquaculture since 2010 starting from backyard aquaculture to community fish farming.

More progress is seen in the sector of a financial, human, and social part as they are more dependent on local level resources available and micromanagement. But in the part of physical and natural assets, less improvement is achieved compared to others.

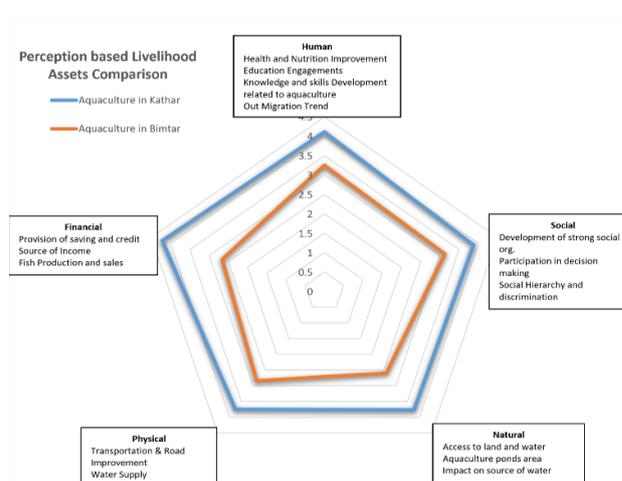


Figure 4: Perception based comparison on capital assets

8.3 Phases of Aquaculture practiced in Bhimtar

8.3.1 Preparation Phase

It was found that there was no formal preparation framework or guidelines. The informal preparation phase practiced during the early years are as follows:

Training: Four farmers attended 3 days of training in Sipaghat in the year 2062 BS.

Group Meeting with Technicians: The inception meeting was called between farmers and fisheries technicians to introduce project features and benefits.

Site Selection: The four farmers were asked to select the pond area in the same location near to the water sources.

8.3.2 Execution Phase

This 6 to 9 months' time period fieldwork started from the excavation of pond until harvesting fishes. In the month of Falgun, all four ponds were provided a total of 200 catfish fingerlings and were grown till Kartik. Then the pond was dried out and maintained for the next lot of fingerlings. Nine months of work resulted in the following fish production of 124 kg of fishes from 5 ponds and were sold at the rate of Nrs 400 per kg in 2075 BS.

8.3.3 Supply Phase

Harvesting pattern is found to be dependent on festivals. They wait till Dasain and Tihar for harvesting fishes to sell them to Bhimtar and villages nearby. All the fishes will be sold from the pond itself without taking them to the nearby market. Therefore, there doesn't exist any marketing channel as producers and consumers are linked directly.

8.4 Problems faced in different phases of Aquaculture:

Livelihood sustainability is also affected by external factors, referred to as the vulnerability context, comprising cycles (e.g. seasonality), trends, and shocks that are beyond the household's control [10]. SLA from DFID has discussed the problems of the livelihood as vulnerabilities. Depending upon the nature of vulnerabilities, problems of aquaculture are categorized on the table.

S n	Vulnerabilities	Strong Impact	Milder Impact	Aquaculture Phase
1	Shocks	Pond Boundary falling down Heavy Rainfall Ineffective training	Flood Drought Pond poisoning Illness to farmers	Execution phase: Lack of proper Capital Assets
2	Trends	Lack of interest from government The communication gap between farmers and donors Less participation in meetings and decision making	Population change Environmental Change	Preparation Phase: Conflict socio-economic system for initiating aquaculture
3	Seasonality	Low fish production Shortage of fingerlings and feedings Unsustainable harvesting	Lack of Investment	Supply phase: Unsustainable Livelihood Practice

Figure 5: Problems in Bhimtar Aquaculture

8.5 Livelihood Outcomes:

Livelihood outcomes are achievements. It is not only about maximizing income. It is also about understanding the richness of potential livelihood goals. Despite poor resources, livelihood outcomes for fish farming are positive. From the case of Bhimtar, following livelihood outcomes can be figured out.

8.5.1 More Income:

From the table, it is clear that from the same land area of 100 sqft, total earning was 2480 NRs from Aquaculture, which is more than 6 times earnings from that of Agriculture. Unlike agriculture, the whole earning comes in terms of cash and hence other expenses can be afforded easily. Aquaculture has certainly increased the income of the farmers.

S	Description	Aquaculture	Agriculture
1	Area sqft	2000	5476
2	Production worth (NRs)	49600	21300
3	Production per 100 sqft	2480	388.97
4	Daily Engagement	About 2 hrs	Whole day work during plantation, cleaning, and harvesting

Figure 6: Comparison Agriculture and Aquaculture

8.5.2 Increased Well being:

With less labor-intensive work of daily 2 to 3 hours in the pond, it will be enough to achieve the best harvest from Aquaculture, whereas agriculture work schedule and engagement is quite difficult. Though fish farmers haven't formed any formal group, they work in a group for the benefit of each other. This has built social security and inclusion among themselves.

8.5.3 Reduced Vulnerabilities:

In this context, Bhimtar aquaculture seems slightly behind. There is a high chance of sweeping the boundary of the pond with fishes during the rainy season as the pond is near to water resources. Similarly, a predator attack on fish is another problem in the case area. But with proper infrastructure to fight flood and fencing will reduce the vulnerability. The study shows that they are even more vulnerable to the economic sector as well.

8.5.4 Improved Food Security:

Food insecurity is a core dimension of vulnerability. However, the case of hunger is not seen in the village. Agriculture and aquaculture have contributed enough to reach the state of zero hunger. Though it was found that the fish consumption rate is not increased from before, they don't have to depend on formalin coated market fishes if they want to eat.

8.5.5 More Sustainable use of Natural Base:

Aquaculture is not only a livelihood but also a whole ecosystem where land, water, and aquatic life are major natural resources. Water resources and its pollution control are well maintained by collecting the water from the canal, using it for a year or more, and again reusing it for irrigation. This water-usage cycle has productively benefitted both in terms of agriculture and aquaculture. And the land is also well utilized to gain large economic benefits.

8.6 Key constraints in fish farming in Bhimtar:

From the study of Bhimtar Majhi Communities, the constraints on the further development of aquaculture are identified as follows:

- **Lack of Capital for Investment:** Having spare money for investing in ponds, fingerlings, and feeds to the fishes after meeting basic needs for majhi is unexpected. Access to loans for farming from banks is likely to be impossible for them. On the other hand, the existing co-operative is not financially strong to provide a larger amount of loan. And unlike other districts, Bhimtar is not privileged with any kind of subsidy or government budget to motivate the small farmers for fish farming. Therefore, the lack of capital to start fish farming is a major constraint for the community.

- **Lack of Institutional Support:** There seems no vision and strategy from any institutions for aquaculture and support the farmers for strengthening marginal economies, increasing employment, and reducing food prices. On the other hand, Majhis are not aware of the benefits that can be achieved from the DADO and local bodies in the form of loans, credit, subsidy, grants, technical assistance, and training.

- **Dependency Syndrome:** From the field study, it is seen that farmers are habituated on seeking aid and assistance from the NGO and INGOs. They are dependent on the donors for aid to construct and manage ponds. Once the pond is constructed, they are seeking fingerlings from them. They are ready to wait and get the fingerlings for free without caring for the fish farming season.

- **Lack of appropriate site:** Since every HH doesn't have the site close to the water source. And there is no provision of the canal for water collection. Therefore, interested farmers have to take the land in lease

increasing the operating cost of fish farming.

- **Lack of adequate technical knowledge:** Detail knowledge of every activity and steps involved in fish farming should be known to overcome obstacles coming during aquaculture. It is best achieved from training and regular interaction with technicians. But having single training around 15 years back (without regular refresher training) and doing aquaculture without technical supervision might have led to less productivity.

8.7 Strategical Improvement Livelihood Framework

To help fish farmers, increase production, and hence increase aquaculture profits to improve livelihoods, their problems need to be taken care of. The problems due to poor capital assets, conflict socio-economic system for initiating aquaculture, and unsustainable livelihood practice have to be resolved to strengthen the community and aquaculture together. Mitigating those problems is one of the strategies for improvement in existing aquaculture and therefore livelihood framework for aquaculture in Bhimtar is developed under the reference of DFID SLA. It is a map of opportunity, where farmers get access to the institutions to improve the livelihood from aquaculture. The model consists of the following three zones as shown in the chart below:

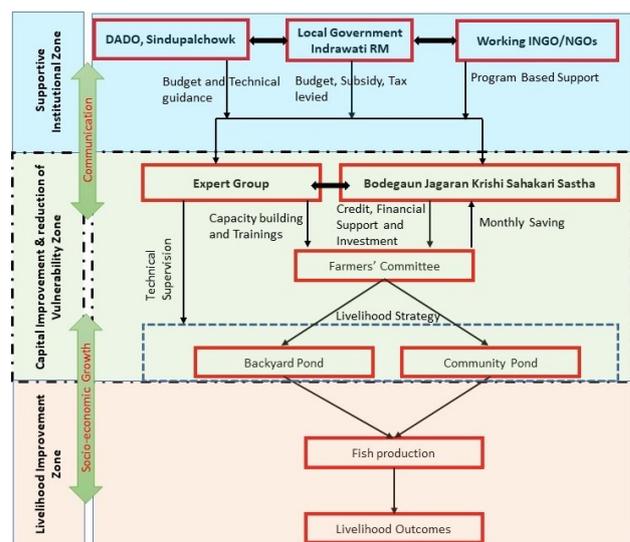


Figure 7: Opportunity Map: livelihood Framework

A. Supportive Institutional Zone: For the case of Bhimtar, this zone consists of institutions of District Agriculture Development Office of Sindupalchowk, Indrawati Rural Municipality, and working

INGOs/NGOs on the top tier who can resource the community through human experts and financial support for the progress of aquaculture development in the community. From the stakeholder analysis, these institutions have higher power and influence on the development of aquaculture in Bhimtar.

B. Capital Improvement and reduction of Vulnerability Zone: This is the area where the fishing community is strengthened through increasing accessibility to the capital assets- undertaking all goal-oriented activities under the direct supervision of expert groups and local co-operative.

C. Livelihood Improvement Zone: This the zone where the livelihood outcomes are seen in chronological order. It should start with high healthy fish production to the socio-economic growth of the fish farmers and a greater number of Majhis engaging in fish farming.

In this model, local cooperative play the key role as it becomes the means to link the farmers to the institutions where this linkage was absent before. This linkage is necessary because these indigenous farmers' socio-political access to the institution's benefits is relatively zero. So, a bottom-up approach has to be backed up by local cooperative for enjoying the privilege of subsidy, loans, and budgets of aquaculture development. The holistic progress in the field has to be supported with technical intervention. In the case of Bhimtar, periphyton based aquaculture will be suitable, where the small plants are allowed to grow on the surface of the physical object like bamboo and such plants are the foods for the fishes which in return reduce the feeding costs significantly. This will not only develop aquaculture as the sustainable livelihood of the people but also empower them to participate in the achievement of SDGs in their daily lives.

9. Conclusion and Recommendation

9.1 Conclusion

From the study of the SLA framework, it is clear that improvement in capital assets overcoming vulnerabilities and positive livelihood outcomes are the bases for sustainable livelihood. Capital assets provide the platform for any livelihood activities to contest against shocks and stress and enhance livelihood outcomes to establish them as sustainable livelihoods. The Majhi community of Bhimtar-dependent on agriculture, backward in all five capital

assets, especially in financial and human capital are attempting aquaculture as their livelihood activities. Aquaculture in Bhimtar is based on limited resources, mostly depending on the donors at the beginning of the season. With no training and workshops for a decade, they have been practicing aquaculture and still making 6 times profits than agriculture same area. It was found 1 sqft of the pond, 0.06 kg of fishes were produced in the year 2075. But this production very low compared to the case study of Srijansil Mahila Macha Palan Samuha, where they produced 0.2 kg from per sq ft from similar size backyard aquaculture. The scenario of less fish production, no training, ineffective fund handling, and vulnerable capital assets suggest the need for meaningful intervention to the aquaculture system. Therefore, an improved aquaculture system is necessary to mitigate those issues, and mitigation strategies are suggested through the livelihood framework. This improved aquaculture promotes the formation of farmers' groups, build relation with the government, adopt a different strategy of fish farming, and seek expert's assistance to develop aquaculture as a sustainable livelihood. And as a part of livelihood, aquaculture benefits the locals with many livelihood outcomes which are simultaneously contributing to bring prosperity and achieve SDGs at the local level, though Majhis are not aware of SDGs. The potential for growth of aquaculture is evidenced in Bhimtar by observing increased interest of farmer's participation in aquaculture to enjoy higher profit returns. A partnership between local government, and farmers groups and the sustainable use of local resources will strengthen the aquaculture extension to welcome those farmers to be a part of the practice. So, income generation and fish production will serve many indigenous farmers to overcome poverty and hunger respectively. This improved aquaculture provides a platform where farmers, experts, and government work together to establish aquaculture as one of the major livelihoods of Majhis and to achieve the associated SDGs.

9.2 Recommendation

Livelihood Diversification:

Aquaculture can go parallel with agriculture and animal husbandry. Integrated fish farming has been successful in many South-Asian communities. Vegetable farming along the boundary of the river is found productive in Chitwan. Therefore, being

specific to Bhimtar, there is a possibility of keeping ducks and vegetable farming for the backyard pond. This activity will mutually benefit all three practices keeping the pond clean. On the other hand, khet still available near Indrawati river can be used for rice-fish farming and achieve multiple harvests.

Role of local level policymakers:

The role of policy makers should be focused towards capital assets development so that not only aquaculture other day to day life will also be ease and comfortable. Some of the interventions that has to be carried out under them are:

- Local government should prioritize on building irrigation canal for mutual benefit of both aquaculture and agriculture purpose.
- They should facilitate community for accessing public/government land to build community ponds apart of budget allocation for pond building.
- Majhis are not vocal and expressive. So, government should reach them about the budget and benefits available for aquaculture via various medium and then expect their inquiry for institutional support on meeting criteria.
- They should implement rules for the existing crusher industry to provide regular assistance in infrastructure and capacity building of the community.
- For long term aquaculture existence, they should also work for establishing fishing hatcheries and nursery including market management. This will inspire more majhis to practice aquaculture as their livelihood.

Role of farmers:

It is clear that Bhimtar farmers have a mindset of not initiating anything new things individually as they are dependent to projects. So, awareness and trainings are necessary to build their confidence and increase participation. Specific to aquaculture, they should practice what they have learned and have to build sense of ownership on projects. Self-awareness development should be one of the concern issues that they should be focused on. They should develop the habit of sustainable use of water resources and maintaining cleanliness around the pond to prevent outbreak of diseases. Training should be able to cover these issues.

Training and Participation

People are unable to attend the meeting due to

logistical and social constraints and sometimes inadvertently miss the process. To avoid such issues in Bhimtar, meeting points should be selected conveniently situated, politically, and institutionally neutral and socially accessible venues. Since the local cooperative bound the farmers with common objectives, such places should be given priority. On the other hand, most of the Majhi farmers haven't attained any formal education. In such a case, field-based practical exercise under the guidance of technical experts should be emphasized. This sort of activity promotes adaptive learning and effective transfer of technology. It is not to forget that women involvement in fish farming is inseparable but the Majhis are not socially active. Therefore, such training should prioritize women participation in their capacity building and confidence development.

Set and achieve livelihood outcomes target:

The development projects should work within the existing system, working in partnership to effect change on a mutually agreed basis [11]. Therefore, all stakeholders must come into common goals and target for the livelihood outcomes from aquaculture under the existing socio-cultural system of the Majhi communities. One of the proposed recommendations is to prepare and record targets of the aquaculture by the local cooperative working together with technical experts. At least target for the aspects like fish productions, household consumptions and market sale, savings to the cooperative, and numbers of meetings for discussion in groups and training in a given timeframe should be set. This will for sure motivate the farmers to achieve the targets and meanwhile help cooperative to track outcomes of individuals fish farmers and their issues at the micro-level. This sort of data is very important while communicating with other institutions and evaluate the projects.

References

- [1] RC Bhujel. Small-scale aquaculture: Global and national perspectives. 2012.
- [2] Matthias Halwart, Simon Funge-Smith, and John Moehl. The role of aquaculture in rural development. *Review of the State of World Aquaculture, FAO, Rome*, pages 47–58, 2003.
- [3] Ram P Chaudhary. *Nepal fourth national report to the convention on biological diversity*. Government of Nepal, Ministry of Forests and Soil Conservation, 2009.

- [4] National Planning Commission. An approach paper to the thirteenth plan (fy 2013/14-2015/16). Technical report, Government of Nepal, 2013.
- [5] TB Gurung, KK Upadhyaya, GBN Pradhan, and MK Shrestha. Fisheries and aquaculture policy for education, research and extension in nepal. *Small-scale Aquaculture for Rural Livelihoods*, page 6, 2012.
- [6] District Development Committee-Sindupalchowk. Annual district development plan, sindupalchowk. Technical report, Government of Nepal, 2017.
- [7] Overseas Development Institute. Aquaculture. Technical report, Department of International Development, 1999.
- [8] Lasse Krantz. The sustainable livelihood approach to poverty reduction. *SIDA. Division for Policy and Socio-Economic Analysis*, 44, 2001.
- [9] MAH Mondal, MM Ali, PK Sarma, and MK Alam. Assessment of aquaculture as a means of sustainable livelihood development in fulpur upazila under mymensingh district. *Journal of the Bangladesh Agricultural University*, 10(452-2016-35668):391–402, 2012.
- [10] Edward H Allison and Benoit Horemans. Putting the principles of the sustainable livelihoods approach into fisheries development policy and practice. *Marine policy*, 30(6):757–766, 2006.
- [11] Peter Edwards, David Little, and Harvey Demaine. *Rural aquaculture*. Cabi, 2002.